ORDER NO. MTC9504596F1
B5

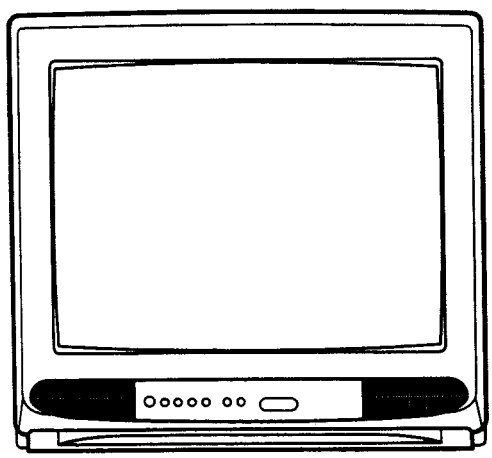
Service Manual

Simplified

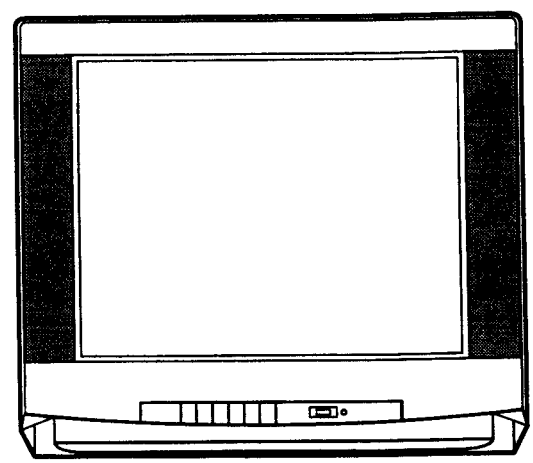
Color Television

Models	Chassis
CT–20G20T	AEDP257
CT–20G20T–1	AEDP257
CT–20G20CT	AMEDP257
CT–20G20CT–1	AMEDP257
CT–20G30T	ALEDP257
CT–20G30T–1	ALEDP257

(NA3C)



CT–20G20T/–1 & CT–20G20CT/–1



CT–20G30T/–1

For service information on Models CT–20G20T/–1 / CT–20G20CT/–1 and CT–20G30T/–1 please file and use this SIMPLIFIED Service Manual together with the Supplemental Service Manual, Order No. MTC9504597F1.

Included in this Simplified Service Manual is a Complete Replacement Parts List and Schematic Diagrams.

NOTE: The Service Technician is required to read and follow the "Safety Precautions" and "Important Safety Notice" in this manual.

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Important Safety Notice

There are special components used in this television set which are important for safety. These parts are identified on the schematic diagram by the symbol ⚠ and printed in **BOLD TYPE** on the replacement parts list. It is essential that these critical parts should be replaced with manufacturer's specified parts to prevent X–RADIATION, shock, fire or other hazards. Do not modify the original design without the permission of manufacturer.

Safety Precautions

General Guidelines

An ISOLATION TRANSFORMER should always be used during the servicing of a receiver whose chassis is not isolated from the AC power line. Use a transformer of adequate power rating as this protects the technician from accidents resulting in personal injury from electrical shocks. It will also protect the receiver and its components from being damaged by accidental shorts of the circuitry that may be inadvertently introduced during the service operation.

When servicing observe the original lead dress, especially in the high voltage circuit. In case of a short circuit, replace every part which has overheated.

Always REPLACE PROTECTIVE DEVICES, such as fishpaper, isolation resistors and capacitors and shields after working on the receiver. Use only manufacturers recommended rating for fuses, circuit breakers, etc.

High potentials are present when this set is operating. Operation of the set without the rear cover involves the danger of electric shock from the set's power supply. Servicing should not be attempted by anyone who is not thoroughly familiar with the precautions necessary when working on high–voltage equipment.

Extreme care should be used in HANDLING THE PICTURE TUBE. Rough handling may cause it to implode due to atmospheric pressure (14.7 lbs per sq. in.). Do not nick or scratch the glass or subject it to any undue pressure in removal or installation. When handling, use safety goggles and heavy gloves for protection. Discharge picture tube by shorting the anode connection to chassis ground (not cabinet or other mounting parts). When discharging, go from cold ground (i.e. dag ground lead) to anode with a well insulated piece of wire.

Avoid prolonged exposure at close range to unshielded areas of the picture tube. Possible danger of personal injury from unnecessary exposure to X–ray radiation may result.

The TEST PICTURE TUBE used for servicing the chassis at the bench should incorporate a safety glass and magnetic shield. The safety glass affords shielding from the tube viewing area against X–ray radiation as well as implosion protection. The magnetic shield limits X–ray radiation around the bell of the picture tube in addition to restricting magnetic effects. When using a picture tube test jig for service, ensure that jig is capable of handling 31kV without causing X–radiation.

BEFORE RETURNING A SERVICED RECEIVER **(of any type)** TO THE OWNER, the service technician must thoroughly test the unit to be certain that it is completely safe to operate without danger of electrical shock. DO NOT USE A LINE ISOLATION TRANSFORMER WHEN MAKING THIS TEST.

Leakage Current Cold Check

Unplug the AC cord and connect a jumper between the two plug prongs.

Measure the resistance between the jumpered AC plug and each exposed metallic part such as screwheads, antenna terminals, control shafts, etc. If the exposed metallic part has a return path to the chassis, the reading should be between 240kΩ and 5.2MΩ. When the exposed metal does not have a return path to the chassis, the reading must be infinite.

Leakage Current Hot Check (See Figure)

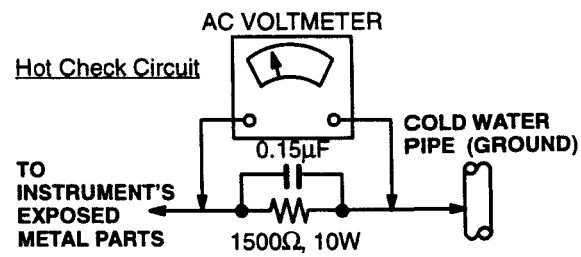
Plug the AC cord directly into the AC outlet. Do not use an isolation transformer during the check.

Connect a 1.5kΩ 10 watt resistor in parallel with a 0.15μF capacitor between each exposed metallic part and ground. Use an earth ground, for example a water pipe.

Using an AC voltmeter with 1000 ohms/volt or more sensitivity, measure the potential across the resistor.

Move the resistor connection to each exposed metallic part and measure the voltage present.

Check that any potential does not exceed 0.75 volt RMS. A leakage current tester (Simpson Model 229, Sencore Model PR57 or equivalent) may be used in the above hot check, in which case any current measure must not exceed 1/2 milliamp. In case any measurement is out of the limits specified, there is a possibility of a shock hazard and the set must be repaired and rechecked before it is returned to the customer.



X–Radiation

WARNING: The potential source of X–radiation in TV sets is the High Voltage section and the picture tube.

NOTE: It is important to use an accurate, periodically calibrated high voltage meter.

Adjust BRIGHTNESS, PICTURE, SHARPNESS and COLOR controls to Minimum.

Measure the High Voltage. The high voltage meter should indicate 28.75kV ±1.25kV. If the upper meter indication is out of tolerance, immediate service and correction is required to insure safe operation and to prevent the possibility of premature component failure.

Horizontal Osc. Disable Circuit Test

This test must be made as a final check before the set is returned to the customer. See HORIZONTAL OSC. DISABLE CIRCUIT PROCEDURE CHECK in this manual.

Specifications

Power Source:	120 volts, 60 Hz, A
Power Consumption:	1.7 amps Max.
Antenna Terminal Impedance:	(1) UHF/VHF 75Ω input
Channel Capability:	181 Channels (Phase 18M Synthesizer)
Off the Air:	VHF 2~13, UHF 14~69
Cable:	125 Channels
Video Input Jack:	1V p–p 75Ω phono jack type
Audio Input Jack (L & R):	500mV RMS, High impedance–10k (phono jack type)
Audio Out/Variable:	0~1V. RMS, 10k (30% Modulation)
Stereo Output Power:	1.5W x 1.5W (10% Distortion)
Comb Filter:	Separates video signal from chroma
AI Sound:	Sound volume is regulated between programs and commercials to maintain a constant output level.
Menu:	Easicon Menu System
Closed Caption Viewing:	Built in Closed Caption decoder provides visual depiction of information contained in the audio portion of a television program.
Remote Control:	Easicon (Universal) Infra–red system EUR501224
Picture Tube:	20" diagonal (Viewing area) 90 degree deflection A51KQN61X A51KQN011X **(all –1 models)**
Anode Voltage:	30kV Max. (Zero beam) 28.75kV ±1.25kV
Dimensions:	**CT–20G30T/–1** Height – 17–13/16" (455mm) Width – 21–5/8" (549mm) Depth – 18–11/16" (475mm) **All other models** Height – 18–1/4" (464mm) Width – 20" (508mm) Depth –19" (429mm)
Weight:	**CT–20G30T/–1** 52 lbs. (23.6 kg) **All other models** 46 lbs. (20.9 kg)

Specifications are subject to change without notice or obligation. Dimensions and weight are approximate measurements.

REPLACEMENT PARTS LIST

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF NO.	PART NO.	DESCRIPTION
		CAPRISTORS
CRA801	**EXNG131P365**	**RES–CAP 130PF/3.6 MEG**
		CAPACITORS
C001	ECKF1H103ZF	CAP,C .01UF–Z–50V
C002	ECEA1EU4R7	CAP,E 4.7UF/25V
C007	ECKF1H101KB	CAP,C 100PF–K–50V
C008	ECKF1H103ZF	CAP,C .01UF–Z–50V
C012	ECEA1HU3R3	CAP,E 3.3UF/50V
C013	ECKF1H103ZF	CAP,C .01UF–Z–50V
C014	ECEA0JU102	CAP,E 1000UF/6.3V
C017	ECEA1CU470	CAP,E 47UF/16V
C018	ECEA0JU101	CAP,E 100UF/6.3V
C019	ECKF1H103ZF	CAP,C .01UF–Z–50V
C021	ECKF1H821KB	CAP,C 820PF–K–50V
C022	ECCF1H330JC	CAP,C 33PF–J–50V
C023	ECCF1H330JC	CAP,C 33PF–J–50V
C025	ECKF1H101KB	CAP,C 100PF–K–50V
C026	ECEA1CU102	CAP,E 1000UF/16V
C028	ECEA1HU4R7	CAP,E 4.7UF/50V
C036	ECEA0JU101	CAP,E 100UF/6.3V
C037	ECEA0JU101	CAP,E 100UF/6.3V
C045	ECEA1CU471	CAP,E 470UF/16V
C046	ECKF1H103ZF	CAP,C .01UF–Z–50V
C055	ECCF1H680J	CAP,C 68PF–J–50V
C056	ECCF1H680J	CAP,C 68PF–J–50V
C060	ECKF1H103ZF	CAP,C .01UF–Z–50V
C061	ECEA0JU101	CAP,E 100UF/6.3V
C063	ECKF1H102KB	CAP,C .001UF–K–50V
C064	ECKF1H392KB	CAP,C .0039–K–50V
C101	ECKF1H103ZF	CAP,C .01UF–Z–50V
C102	ECEA1CU100	CAP,E 10UF/16V
C103	ECKF1H103ZF	CAP,C .01UF–Z–50V
C104	ECEA1HUR22	CAP,E .22UF/50V
C105	ECCF1H270JC	CAP,C 27PF–J–50V
C106	ECKF1H122KB	CAP,C .0012UF–K–50V
C107	ECEA1HUR47	CAP,E .47UF/50V
C108	ECEA1CN100S	CAP,E 10UF/16V
C109	ECEA0JU101	CAP,E 100UF/6.3V
C110	ECKF1H103ZF	CAP,C .01UF–Z–50V
C113	ECEA1CU100	CAP,E 10UF/16V
C114	ECKF1H103ZF	CAP,C .01UF–Z–50V
C123	ECCF1H010CC	CAP,C 1PF–C–50V
C147	ECCF1H330JC	CAP,C 33PF–J–50V
C151	ECEA1HUR22	CAP,E .22UF/50V
C152	ECCF1H680JC	CAP,C 68PF–J–50V
C153	ECCF1H150JC	CAP,C 15PF–J–50V
C201	ECCF1H680JP	CAP,C 68PF–J–50V
C202	ECKF1H103ZF	CAP,C .01UF–Z–50V
C203	ECKF1H103ZF	CAP,C .01UF–Z–50V
C207	ECEA1CN100S	CAP,E 10UF/16V
C301	ECEA1CU100	CAP,E 10UF/16V
C302	ECEA1AU331	CAP,E 330UF/10V
C303	ECEA1EU4R7	CAP,E 4.7UF/25V
C304	ECEA1EU4R7	CAP,E 4.7UF/25V
C305	ECEA1HUR33	CAP,E .33UF/50V
C306	ECEA1HU010	CAP,E 1UF/50V
C309	ECEA1HN010S	CAP,E 1UF/50V
C312	ECEA1CU220	CAP,E 22UF/16V
C313	ECCF1H390K	CAP,C 39PF–K–50V
C316	ECCF1H820JC	CAP,C 82PF–J–50V
C351	ECKF1H391KB	CAP,C 390PF–K–50V
C352	ECKF1H391KB	CAP,C 390PF–K–50V
C353	ECKF1H681KB	CAP,C 680PF–K–50V
C355	ECKD3D102KB	CAP,C .001UF–K–2KV
C359	ECKF1H221KB	CAP,C 220PF–K–50V
C401	ECEA1HUR33	CAP,E .33UF/50V
C402	ECKF1H681KB	CAP,C 680PF–K–50V
C403	ECEA1HN010S	CAP,E 1UF/50V
C451	ECEA1CGE221	CAP,E 220UF/16V
C452	ECSF1EE105	CAP,T 1.0UF/25V
C453	ECEA50Z2R2	CAP,E 2.2UF/50V
C454	ECEA1EU102	CAP,E 1000UF/25V
C455	ECEA1VU101	CAP,E 100UF/35V
C456	ECQB1H473KF	CAP,P .047UF–K–50V
C457	ECEA1HGE0R1	CAP,E .1UF/50V
C458	ECEA1EU4R7	CAP,E 4.7UF/25V
C461	ECEA1HU010	CAP,E 1UF/50V
C501	ECKF1H331KB	CAP,C 330PF–K–50V
C502	ECEA1HU010	CAP,E 1UF/50V
C503	ECQB1H333KF	CAP,P .033UF–K–50V
C504	ECKF1H103ZF	CAP,C .01UF–Z–50V
C505	ECQB1H103KF	CAP,P .01UF–K–50V
C506	ECEA1AU221	CAP,E 220UF/10V
C507	ECKF1H221KB	CAP,C 220PF–K–50V
C508	ECQB1H223KF	CAP,P .022UF–K–50V
C509	ECCF1H221JU	CAP,C 220PF–J–50V
C510	ECCD2H100D	CAP,C 10PF–D–500V
C511	ECKD2H821KB	CAP,C 820PF–K–500V
C515	ECKD2H821KB	CAP,C 820PF–K–500V
C531	ECEA1EU330	CAP,E 33UF/25V
C532	ECEA1EU4R7	CAP,E 4.7UF/25V
C541	ECCF1H121JC	CAP,C 120PF–J–50V
C543	ECCF1H101JC	CAP,C 100PF–J–50V
C552	ECEA1EU221	CAP,E 220UF/25V
C554	ECKD2H561KB	CAP,C 560PF–K–500V
C555	ECEA2EU100	CAP,E 10UF/250V
C557	ECEA1EFS330	CAP,E 33UF/25V
C559	ECEA1EFS221	CAP,E 220UF/25V
C560	ECEA1EU220	CAP,E 22UF/25V
C561	ECEA1HU2R2	CAP,E 2.2UF/50V
C562	ECKD2H561KB	CAP,C 560PF–K–500V
C563	**ECWH12H822JS**	**CAP,P .0082UF–J–1.2KV**
C564	**ECKD3D102JB**	**CAP,C .001UF–J–2KV**
C566	**ECKD3D181JB**	**CAP,C 180PF–J–2KV**
C567	ECEA1VGE102	CAP,E 1000UF/35V
C569	**ECQF2H394JS**	**CAP,P .39UF–J–200V**
C570	ECKD2H561KB	CAP,C 560PF–K–500V
C573	ECEA1CU221	CAP,E 220UF/16V
C576	ECKF1H103ZF	CAP,C .01UF–Z–50V
C577	ECKD2H102KB	CAP,C .001UF–K–500V
C601	ECCF1H101J	CAP,C 100PF–J–50V
C602	ECCF1H150JU	CAP,C 15PF–J–50V

REPLACEMENT PARTS LIST

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF NO.	PART NO.	DESCRIPTION
C607	ECCF1H101J	CAP,C 100PF-J-50V
C801	ECKD2H472PU	CAP,C .0047UF-P-500V
C803	ECKD2H472PU	CAP,C .0047UF-P-500V
C804	ECKD2H472PU	CAP,C .0047UF-P-500V
C805	**EC0S2DG331G4**	**CAP,E 330UF/200V**
C806	**ECEA2CU220**	**CAP,E 22UF/160V**
C809	**ECQU2A224MN**	**CAP,P .22UF-M-250VAC**
C812	ECEA160V33Z	CAP,E 33UF/160V
C817	**ECQU2A153MN**	**CAP,P .015UF-M-250VAC**
C818	**ECQU2A153MN**	**CAP,P .015UF-M-250VAC**
C951	ECKF1H223ZF	CAP,C .022UF-Z-50V
C2201	ECEA1EU4R7	CAP,E 4.7UF/25V
C2202	ECEA1EU4R7	CAP,E 4.7UF/25V
C2203	ECEA1EU4R7	CAP,E 4.7UF/25V
C2204	ECQB1H104JF	CAP,P .1UF-J-50V
C2205	ECEA1HUR68	CAP,E .68UF/50V
C2206	ECEA1CU101	CAP,E 100UF/16V
C2207	ECEA1EU4R7	CAP,E 4.7UF/25V
C2208	ECEA1EU4R7	CAP,E 4.7UF/25V
C2209	AP106K016CAE	CAP,T 10UF/16V
C2210	ECQB1H104KF	CAP,P .1UF-K-50V
C2211	AP335K016CAE	CAP,T 3.3UF/16V
C2212	ECEA1HU010	CAP,E 1UF/50V
C2213	ECEA1HUR47	CAP,E .47UF/50V
C2214	ECEA1EU4R7	CAP,E 4.7UF/25V
C2215	ECQB1H104KF	CAP,P .1UF-K-50V
C2216	ECKF1H102KB	CAP,C .001UF-K-50V
C2217	ECQB1H683JF	CAP,P .068UF-J-50V
C2218	ECKF1H222KB	CAP,C .0022UF-K-50V
C2219	ECQB1H103JF	CAP,P .01UF-J-50V
C2220	ECEA1EU4R7	CAP,E 4.7UF/25V
C2301	ECEA1EU471	CAP,E 470UF/25V
C2302	ECEA1CU220	CAP,E 22UF/16V
C2303	ECEA1HU010	CAP,E 1UF/50V
C2304	ECEA1HU2R2	CAP,E 2.2UF/50V
C2305	ECEA1EU102	CAP,E 1000UF/25V
C2306	ECEA1CGE100	CAP,E 10UF/16V
C2307	ECQB1H683KF	CAP,P .068UF-K-50V
C2308	ECKF1H182KB	CAP,C .0018UF-K-50V
C2309	ECEA1CU221	CAP,E 220UF/16V
C2311	ECEA1CU220	CAP,E 22UF/16V
C2312	ECKF1H182KB	CAP,C .0018UF-K-50V
C2313	ECQB1H683KF	CAP,P .068UF-K-50V
C2314	ECEA1CU221	CAP,E 220UF/16V
C2315	ECEA1HU010	CAP,E 1UF/50V
C2316	ECEA1HU010	CAP,E 1UF/50V
C2318	ECEA1HU010	CAP,E 1UF/50V
C2319	ECEA1HU010	CAP,E 1UF/50V
C2323	ECEA1CGE100	CAP,E 10UF/16V
C2451	ECEA1HN010S	CAP,E 1UF/50V
C2452	ECEA1HN010S	CAP,E 1UF/50V
C2453	ECEA1HU4R7	CAP,E 4.7UF/50V
C2454	ECEA1CU221	CAP,E 220UF/16V
C2455	ECEA1CU100	CAP,E 10UF/16V
C2456	ECEA1CU100	CAP,E 10UF/16V
C3104	ECEA1CU100	CAP,E 10UF/16V

REF NO.	PART NO.	DESCRIPTION
		DIODES
D001	ERA15-01	DIODE
D002	MA167	DIODE
D003	MA4047M	DIODE, ZENER
D005	SEL1410G	DIODE, LED
		CT-20G30TM CT-20G30T-1M
D006	MA165	DIODE
D022	MA165	DIODE
D025	MA165	DIODE
D301	MA165	DIODE
D451	ERA15-01	DIODE
D452	MA165	DIODE
D453	MA165	DIODE
D455	MA4120M	DIODE
D501	MA4082L	DIODE
D531	**AS01**	**DIODE**
D532	**MA4062L**	**DIODE, ZENER**
D543	MA4068M	DIODE, ZENER
D551	**TVSRU2NV1**	**DIODE**
D553	**AU02**	**DIODE**
D554	**AU02**	**DIODE**
D555	MA165	DIODE
D556	MA4360H	DIODE, ZENER
D557	MA2051	DIODE
D561	**AU02**	**DIODE**
D562	MA165	DIODE
D563	MA165	DIODE
D801	**EM02BM 1**	**DIODE**
D802	**EM02BM 1**	**DIODE**
D803	**EM02BM 1**	**DIODE**
D804	**EM02BM 1**	**DIODE**
D805	**TRPW5B0M050D**	**THERMISTOR**
D2321	MA165	DIODE
		FUSES
F001	**0BA1C40NU100**	**FUSE 4.0A/125V**
		INTEGRATED CIRCUITS
IC001	MN1873234HYH	INT CKT
IC002	24LC02BIP	INT CKT
IC101	**AN5163K**	**INT CKT**
IC451	LA7835-TV	INT CKT
IC551	AN78M09	PLUS 9V AVR
IC552	AN78L12	INT CKT
IC801	**TVSSTR30130**	**INT CKT**
IC1051	PIC-12042SR	RECEIVER, REMOTE CONTROL
IC2201	AN5817NK	INT CKT
IC2301	AN5265	INT CKT
IC2302	AN5265	INT CKT
IC2303	MC14066BCP	INT CKT
IC2451	AN5285K	INT. CKT.
		COILS
LC301	EIK7EM002Q	DELAY LINE
L001	EXCELSA35	FERRITE BEAD
L003	EXCELSA39	FERRITE BEAD
L011	TLUABTA1R0K	COIL, PEAKING 1.0UH
L021	ELESN390KA	COIL, PEAKING 39UH
L023	TLUABTA100K	COIL, PEAKING 10UH

REPLACEMENT PARTS LIST

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF. NO.	PART NO.	DESCRIPTION
L024	TLUABTA100K	COIL, PEAKING 10UH
L025	TLUABTA100K	COIL, PEAKING 10UH
L101	TLUABTA150K	COIL, PEAKING 15UH
L103	EIV7EN041B	COIL, AFT
L105	EIV7EN053B	VCO
L106	TLQ012K205C	COIL, PEAKING 1.2UH
L107	TLQ012K205C	COIL, PEAKING 1.2UH
L108	TLUABTA1R0K	COIL, PEAKING 1.0UH
L111	ELESN270KA	COIL, PEAKING 27UH
L201	EIS7ES004B	COIL, QUADRATURE
L301	TLUABTA150K	COIL, PEAKING 15UH
L351	TLUABTA151K	COIL, PEAKING 150UH
L541	TLUABTA151K	COIL, PEAKING 150UH
L551	**TLH15652P**	**COIL, LINEARITY**
L552	EXCELSA24	FERRITE BEAD
L553	EXCELSA24	FERRITE BEAD
L558	EXCELSA24	FERRITE BEAD
L601	TLUABTA100K	COIL, PEAKING 10UH
L801	**ELF18D293M**	**LINE FILTER**
DEG	0LK19039A	COIL, DEGAUSSING
		CT-20G20CTC CT-20G20CT1C
DEG	0LK19042A	COIL, DEGAUSSING 20"
		CT-20G20TM CT-20G20T-1M
		CT-20G30TM CT-20G30T-1M
DY	**0LY15307F**	**YOKE, DEFLECTION: INCLS**
		CONVERGENCE
		CT-20G20TM CT-20G30TM
		CT-20G20CTC
DY	**0LY15312F**	**YOKE, DEFLECTION**
		CT-20G20T-1M CT-20G30T-1M
		CT-20G20CT1C
		TRANSISTORS
Q002	JC501PQ	TRANSISTOR
Q003	JC501PQ	TRANSISTOR
Q004	JA101PQ	TRANSISTOR
Q006	JC501PQ	TRANSISTOR
Q007	JC501PQ	TRANSISTOR
Q008	JC501PQ	TRANSISTOR
Q015	JA101PQ	TRANSISTOR
Q306	JC501PQ	TRANSISTOR
Q307	JC501PQ	TRANSISTOR
Q351	2SC3063	TRANSISTOR
Q352	2SC3063	TRANSISTOR
Q353	2SC3063	TRANSISTOR
Q451	JC501PQ	TRANSISTOR
Q452	JC501PQ	TRANSISTOR
Q501	2SC1573AH	TRANSISTOR
Q541	JC501PQ	TRANSISTOR
Q551	**BU2506DF**	**TRANSISTOR**
Q2304	JC501PQ	TRANSISTOR
Q2305	JC501PQ	TRANSISTOR
		RELAYS
RL001	**TSE1864**	**RELAY**
		RESISTORS
R001	ERDS2TJ271	RES,C 270-J-1/4
		CT-20G30TM CT-20G30T-1M
R003	ERDS2TJ562	RES,C 5.6K-J-1/4
R004	ERDS2TJ271	RES,C 270-J-1/4
R005	ERDS2TJ101	RES,C 100-J-1/4
R008	ERD25TJ182	RES,C 1.8K-J-1/4
R013	ERDS2TJ473	RES,C 47K-J-1/4
R018	ERDS2TJ472	RES,C 4.7K-J-1/4
R019	ERDS2TJ472	RES,C 4.7K-J-1/4
R020	ERDS2TJ474	RES,C 470K-J-1/4
R021	ERDS2TJ101	RES,C 100-J-1/4
R022	ERDS2TJ101	RES,C 100-J-1/4
R026	ERDS2TJ102	RES,C 1K-J-1/4
R030	ERD25TJ683	RES,C 68K-J-1/4
R031	ERDS2TJ823	RES,C 82K-J-1/4
R035	ERDS2TJ471	RES,C 470-J-1/4
R037	ERDS2TJ272	RES,C 2.7K-J-1/4
R045	ERDS2TJ822	RES,C 8.2K-J-1/4
R046	ERDS2TJ823	RES,C 82K-J-1/4
R050	ER0S2CKF1002	RES,M 10K-F-1/4
R057	ERDS2TJ820	RES,C 82-J-1/4
R058	ERDS2TJ272	RES,C 2.7K-J-1/4
R059	ERDS2TJ222	RES,C 2.2K-J-1/4
R060	ERDS2TJ332	RES,C 3.3K-J-1/4
R061	ERDS2TJ562	RES,C 5.6K-J-1/4
R062	ERDS2TJ103	RES,C 10K-J-1/4
R063	ERDS2TJ273	RES,C 27K-J-1/4
R065	ERD25TJ102	RES,C 1K-J-1/4
R071	ERD25TJ102	RES,C 1K-J-1/4
R072	ERDS2TJ101	RES,C 100-J-1/4
R074	ERG1ANJ683	RES,M 68K-J-1W
R076	ERDS2TJ103	RES,C 10K-J-1/4
R077	ERDS2TJ103	RES,C 10K-J-1/4
R080	ERDS2TJ122	RES,C 1.2K-J-1/4
R081	ERDS2TJ391	RES,C 390-J-1/4
R083	ERDS2TJ103	RES,C 10K-J-1/4
R085	ERDS2TJ334	RES,C 330K-J-1/4
R086	ERDS2TJ684	RES,C 680K-J-1/4
R087	ERDS2TJ272	RES,C 2.7K-J-1/4
R088	ERD25TJ223	RES,C 22K-J-1/4
R089	ERDS2TJ392	RES,C 3.9K-J-1/4
R091	ERDS2TJ272	RES,C 2.7K-J-1/4
R092	ERDS2TJ223	RES,C 22K-J-1/4
R093	ERDS2TJ103	RES,C 10K-J-1/4
R094	ERDS2TJ393	RES,C 39K-J-1/4
R097	ERD25TJ102	RES,C 1K-J-1/4
R102	ERDS2TJ683	RES,C 68K-J-1/4
R103	ERDS2TJ183	RES,C 18K-J-1/4
R104	ERDS2TJ121	RES,C 120-J-1/4
R105	ERDS2TJ102	RES,C 1K-J-1/4
R106	EVND2AA03B14	CONTROL 10K
R107	ERDS2TJ222	RES,C 2.2K-J-1/4
R111	ERDS2TJ361	RES,C 360-J-1/4
R112	ERDS2TJ561	RES,C 560-J-1/4
R152	ERDS2TJ154	RES,C 150K-J-1/4
R201	ERDS2TJ221	RES,C 220-J-1/4
R202	ERDS2TJ682	RES,C 6.8K-J-1/4
R203	ERDS2TJ392	RES,C 3.9K-J-1/4

REPLACEMENT PARTS LIST

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF. NO.	PART NO.	DESCRIPTION
R204	ERDS2TJ472	RES,C 4.7K–J–1/4
R206	ERQ2CJP100	RES,F 10–J–2W
R301	ERDS2TJ822	RES,C 8.2K–J–1/4
R302	ERDS2TJ103	RES,C 10K–J–1/4
R304	ERDS2TJ274	RES,C 270K–J–1/4
R305	ERDS2TJ102	RES,C 1K–J–1/4
R306	ERDS2TJ102	RES,C 1K–J–1/4
R307	ERDS2TJ103	RES,C 10K–J–1/4
R317	ERDS2TJ152	RES,C 1.5K–J–1/4
R318	ERDS2TJ681	RES,C 680–J–1/4
R324	ERD25TJ121	RES,C 120–J–1/4
R326	ERDS2TJ471	RES,C 470–J–1/4
R327	ERDS2TJ682	RES,C 6.8K–J–1/4
R328	ERDS2TJ332	RES,C 3.3K–J–1/4
R339	ERD25TJ514	RES,C 510K–J–1/4
R351	ERG2ANJ123	RES,M 12K–J–2W
R352	ERG2ANJ123	RES,M 12K–J–2W
R353	ERG2ANJ123	RES,M 12K–J–2W
R354	ERDS1TJ272	RES,C 2.7K–J–1/2
R355	ERDS1TJ272	RES,C 2.7K–J–1/2
R356	ERDS1TJ272	RES,C 2.7K–J–1/2
R357	ERDS2TJ271	RES,C 270–J–1/4
R358	ERDS2TJ271	RES,C 270–J–1/4
R359	ERDS2TJ271	RES,C 270–J–1/4
R360	ERDS2TJ182	RES,C 1.8K–J–1/4
R361	ERDS2TJ182	RES,C 1.8K–J–1/4
R362	ERDS2TJ182	RES,C 1.8K–J–1/4
R364	ERDS2TJ101	RES,C 100–J–1/4
R365	ERDS2TJ101	RES,C 100–J–1/4
R366	ERDS2TJ101	RES,C 100–J–1/4
R401	ERDS2TJ224	RES,C 220K–J–1/4
R402	ERDS2TJ561	RES,C 560–J–1/4
R404	ERDS2TJ221	RES,C 220–J–1/4
R451	ERDS2TJ681	RES,C 680–J–1/4
R452	ERDS2TJ333	RES,C 33K–J–1/4
R453	EVND2AA03B34	CONTROL 30K
R454	ERDS1FJ1R8	RES,C 1.8–J–1/2
R455	ERDS2TJ223	RES,C 22K–J–1/4
R456	ERDS2TJ332	RES,C 3.3K–J–1/4
R457	ERDS2TJ152	RES,C 1.5K–J–1/4
R458	ERDS2TJ333	RES,C 33K–J–1/4
R459	ERDS2TJ102	RES,C 1K–J–1/4
R462	ERD25TJ473	RES,C 47K–J–1/4
R463	ERDS2TJ224	RES,C 220K–J–1/4
R464	ERDS2TJ124	RES,C 120K–J–1/4
R466	ERDS2TJ101	RES,C 100–J–1/4
R467	ERD25TJ102	RES,C 1K–J–1/4
R470	ERDS2TJ153	RES,C 15K–J–1/4
R471	ERDS2TJ271	RES,C 270–J–1/4
R472	ERDS2TJ103	RES,C 10K–J–1/4
R501	ERDS2TJ102	RES,C 1K–J–1/4
R502	ERDS2TJ222	RES,C 2.2K–J–1/4
R503	ERDS2TJ392	RES,C 3.9K–J–1/4
R504	ERDS2TJ821	RES,C 820–J–1/4
R505	ERDS2TJ472	RES,C 4.7K–J–1/4
R506	ERDS2TJ680	RES,C 68–J–1/4

REF. NO.	PART NO.	DESCRIPTION
R507	ERDS2TJ562	RES,C 5.6K–J–1/4
R508	ERDS2TJ822	RES,C 8.2K–J–1/4
R509	ERG2ANJ562	RES,M 5.6K–J–2W
R510	**ERG2ANJ911**	**RES,M 910–J–2W**
R511	**ERG2ANJ911**	**RES,M 910–J–2W**
R516	ERD25TJ391	RES,C 390–J–1/4
R517	ERDS2TJ224	RES,C 220K–J–1/4
R531	**ERD25FJ470**	**RES,C 47–J–1/4**
R532	**ER025CKF4422**	**RES,M 44.2K–F–1/4**
R533	**ER0S2CKF7151**	**RES,M 7.15K–F–1/4**
R534	**ERDS2TJ684**	**RES,C 680K–J–1/4**
R538	**ERDS2TJ821**	**RES,C 820–J–1/4**
R539	**ERDS2TJ681**	**RES,C 680–J–1/4**
R541	ERDS2TJ103	RES,C 10K–J–1/4
R542	ERDS2TJ121	RES,C 120–J–1/4
R544	ERD25TJ562	RES,C 5.6K–J–1/4
R547	ERDS2TJ222	RES,C 2.2K–J–1/4
R551	**ERDS1FJ1R0**	**RES,C 1.0–J–1/2**
R552	**ERDS1FJ1R0**	**RES,C 1.0–J–1/2**
R553	**ERDS1FJ1R0**	**RES,C 1.0–J–1/2**
R554	ERDS2TJ104	RES,C 100K–J–1/4
R555	ERDS2TJ124	RES,C 120K–J–1/4
R556	ERDS2TJ332	RES,C 3.3K–J–1/4
R557	ERDS2TJ103	RES,C 10K–J–1/4
R558	ERQ1CJPR82	RES,F .82–J–1W
R559	ERG3ANJ680	RES,M 68–J–3W
R560	ERG2ANJ620	RES,M 62–J–2W
R562	ERG2ANJ122	RES,M 1.2K–J–2W
R563	ERDS1TJ681	RES,C 680–J–1/2
R566	ERDS2TJ221	RES,C 220–J–1/4
R601	ERDS2TJ332	RES,C 3.3K–J–1/4
R602	ERDS2TJ182	RES,C 1.8K–J–1/4
R604	ERDS2TJ331	RES,C 330–J–1/4
R605	ERDS2TJ331	RES,C 330–J–1/4
R606	ERDS2TJ331	RES,C 330–J–1/4
R607	ERDS2TJ222	RES,C 2.2K–J–1/4
R608	ERDS2TJ222	RES,C 2.2K–J–1/4
R609	ERDS2TJ222	RES,C 2.2K–J–1/4
R610	ERDS2TJ182	RES,C 1.8K–J–1/4
R611	ERDS2TJ681	RES,C 680–J–1/4
R612	ERDS2TJ681	RES,C 680–J–1/4
R613	ERD25TJ681	RES,C 680–J–1/4
R614	ERDS2TJ222	RES,C 2.2K–J–1/4
R615	ERDS2TJ103	RES,C 10K–J–1/4
R616	ERDS2TJ103	RES,C 10K–J–1/4
R617	ERDS2TJ103	RES,C 10K–J–1/4
R618	ERD25TJ392	RES,C 3.9K–J–1/4
R619	ERDS2TJ331	RES,C 330–J–1/4
R801	**ERF7ZKR82**	**RES,W .82–K–7W**
R802	**ERF20ZJ181**	**RES,W 180–J–20W**
R803	**ERF5ZJ681**	**RES,W 680–J–5W**
R804	ERDS2TJ224	RES,C 220K–J–1/4
R805	**ERDS1FJ103**	**RES,C 10K–J–1/2**
R807	**ERD25FJ470**	**RES,C 47–J–1/4**
R808	**ERD25FJ330**	**RES,C 33–J–1/4**
R810	**ERF5ZK8R2**	**RES,W 8.2–K–5W**

REPLACEMENT PARTS LIST

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF. NO.	PART NO.	DESCRIPTION
R815	**ERC12ZGM825**	**RES,S 8.2MEG–M–1/2**
R816	**ERW12PK1R0**	**RES,W 1.0–K–1/2**
R2201	ERDS2TJ512	RES,C 5.1K–J–1/4
R2202	ERDS2TJ112	RES,C 1.1K–J–1/4
R2203	ER0S2CKF5602	RES,M 56K–F–1/4
R2204	ERDS2TJ562	RES,C 5.6K–J–1/4
R2205	ERDS2TJ153	RES,C 15K–J–1/4
R2206	ERDS2TJ823	RES,C 82K–J–1/4
R2207	ERDS2TJ153	RES,C 15K–J–1/4
R2208	ERDS2TJ154	RES,C 150K–J–1/4
R2209	EVND8AA03B54	CONTROL 50K
R2210	ERDS2TJ134	RES,C 130K–J–1/4
R2211	ERDS2TJ154	RES,C 150K–J–1/4
R2212	ERDS2TJ302	RES,C 3K–J–1/4
R2213	EVND8AA03B54	CONTROL 50K
R2219	ERDS2TJ223	RES,C 22K–J–1/4
R2220	EVND8AA03B24	CONTROL 20K
R2221	EVND8AA03B34	CONTROL 30K
R2222	ERDS2TJ153	RES,C 15K–J–1/4
R2223	ERDS2TJ393	RES,C 39K–J–1/4
R2226	ERDS2TJ474	RES,C 470K–J–1/4
R2228	ERDS2TJ102	RES,C 1K–J–1/4
R2245	ERDS2TJ102	RES,C 1K–J–1/4
R2247	ERDS2TJ102	RES,C 1K–J–1/4
R2248	ERDS2TJ102	RES,C 1K–J–1/4
R2301	ERD25TJ752	RES,C 7.5K–J–1/4
R2302	ERDS2TJ823	RES,C 82K–J–1/4
R2303	ERDS2TJ331	RES,C 330–J–1/4
R2304	ERDS2TJ102	RES,C 1K–J–1/4
R2305	ERD25FJ4R7	RES,C 4.7–J–1/4
R2306	ERDS2TJ183	RES,C 18K–J–1/4
R2308	ERDS2TJ183	RES,C 18K–J–1/4
R2309	ERDS2TJ331	RES,C 330–J–1/4
R2310	ERD25FJ4R7	RES,C 4.7–J–1/4
R2311	ERDS2TJ102	RES,C 1K–J–1/4
R2312	ERDS2TJ823	RES,C 82K–J–1/4
R2318	ERDS2TJ103	RES,C 10K–J–1/4
R2319	ERDS2TJ122	RES,C 1.2K–J–1/4
R2320	ERDS2TJ103	RES,C 10K–J–1/4
R2321	ERDS2TJ122	RES,C 1.2K–J–1/4
R2322	ERDS2TJ272	RES,C 2.7K–J–1/4
R2323	ERDS2TJ334	RES,C 330K–J–1/4
R2324	ERDS2TJ272	RES,C 2.7K–J–1/4
R2325	ERDS2TJ334	RES,C 330K–J–1/4
R2334	ERDS2TJ103	RES,C 10K–J–1/4
R2335	ERDS2TJ223	RES,C 22K–J–1/4
R2338	ERDS2TJ473	RES,C 47K–J–1/4
R2339	ERDS2TJ104	RES,C 100K–J–1/4
R2343	ERDS2TJ752	RES,C 7.5K–J–1/4
R2451	ERDS2TJ225	RES,C 2.2MEG–J–1/4
R2454	ERDS2TJ243	RES,C 24K–J–1/4
R2455	ERDS2TJ103	RES,C 10K–J–1/4
R2457	ERDS2TJ101	RES,C 100–J–1/4
R3101	ERDS2TJ750	RES,C 75–J–1/4
R3120	ERDS2TJ221	RES,C 220–J–1/4
		SWITCHES
S001	EVQQKH06K	SWITCH
S002	EVQQKH06K	SWITCH
S003	EVQQKH06K	SWITCH
S004	EVQQKH06K	SWITCH
S005	EVQQKH06K	SWITCH
S006	EVQQKH06K	SWITCH
S007	EVQQKH06K	SWITCH
S2301	ESB621283	SWITCH, CATV
		TRANSFORMERS
T001	**TLP16297**	**TRANSFORMER, POWER SUPPLY**
T501	**ETH19Y70AYM**	**TRANSFORMER, HORIZONTAL DRIVER**
T502	**ETE19Z30AY**	**TRANSFORMER, HORIZONTAL COUPLING**
T551	**TLF15615F2**	**TRANSFORMER, FLYBACK**
		CRYSTALS/FILTERS
X001	TSS2080MX	CRYSTAL, CLOCK
X101	EFCH45MVK12N	SAW FILTER
X102	EFCWS4504AB	FILTER
X201	EFCS4R5MS4W	FILTER 4.5MHZ BANDPASS
X501	EF0A503KS41	CRYSTAL, OSCILLATOR
X601	TS816M32	CRYSTAL 3.58MHZ OSCILLATOR
		OTHERS
TNR001	ENV568N5G3	TUNER
M001	**A51KQN011X**	**CRT 20"**
		CT–20G20T–1M CT–20G30T–1M
		CT–20G20CT1C
M002	A51KQN61X	CRT 20"
		CT–20G20TM CT–20G30TM
		CT–20G20CTC
M003	EAGG1202B2	ASSY., SPKR
		CT–20G30TM CT–20G30T–1M
M004	EASG9D523A2	SPEAKER, 2" X 3–1/2" 16 OHM
		CT–20G20TM CT–20G20T–1M
		CT–20G20CTC CT–20G20CT1C
M005	EUR501224	TRANSMITTER, REMOTE CTRL
M006	TBM2A30832	BADGE, PANASONIC
M007	TBX1886601	PUSHBUTTON, SPEAKER
M008	TBX2A50231G	ASSY. 7 PUSHBUTTOM
		CT–20G20TM CT–20G20T–1M
		CT–20G20CTC CT–20G20CT1C
M009	TES2A20801	SPRING, DAG GROUND
M010	**TJS1A5050**	**CRT SOCKET**
M011	TKP2A11172	SPEAKER GRILLE
		CT–20G30TM CT–20G30T–1M
M012	TKU2A22207M	COVER, CABT. BACK
		CT–20G20TM CT–20G20T–1M
M013	TKP2A90471	OVERLAY, IR
M014	TKX2A3751	GUIDE, IR
		CT–20G20TM CT–20G20T–1M
		CT–20G20CTC CT–20G20CT1C
M015	TKY2A30502C	CABT. FRONT 20"
		CT–20G20CTC CT–20G20CT1C
M016	TMM2A30701	WEDGE, YOKE
M017	TMW2A97121	STRAIN RELIEF: AC LINE CORD
		CT–20G30T–1M CT–20G20CT1C

REPLACEMENT PARTS LIST

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF. NO.	PART NO.	DESCRIPTION
M018	TQB2A0919	MANUAL, OWNER'S CT-20G20TM CT-20G20T-1M CT-20G30TM CT-20G30T-1M
M019	TQB2A0920	MANUAL, OWNER'S CT-20G20CTC CT-20G20CT1C
M020	TQF2A709	LABEL, FRONT SEAL (CT-27S CT-20G20CTC CT-20G20CT1C
M021	**TSX3134X**	**AC LINE CORD** **CT-20G30TM CT-20G30T-1M**
M022	**TSX5140X**	**AC LINE CORD** **CT-20G20TM CT-20G20T-1M** **CT-20G20CTC CT-20G20CT1C**
M023	TXFKY3894SER	ASSY. CABINET FRONT CT-20G20T-1M CT-20G20TM
M024	TXFKU4094SER	ASSY. CABINET BACK
		CT-20G20CT1C CT-20G20CTC
M025	TXFKY2593SER	ASSY. CABINET FRONT CT-20G30TM CT-20G30T-1M
M026	TXFKU3293SER	ASSY. CABINET BACK CT-20G30TM CT-20G30T-1M
M027	TXFMK01H55	CONVERGENCE CORRECTOR STRIP CT-20G20CTC CT-20G20CT1C
M028	TXF3A011DB2	ASSY. DAG GROUND
M029	0FMK014ZZ	CONVERGENCE CORRECTOR STRIP CT-20G20TM CT-20G20T-1M CT-20G30TM CT-20G30T-1M
JK3001	TJB2A9063A	BRKT., A/V VAO A/V IN
M030	T8A262	SILICONE GREASE – HEAT SINK COMPOUND

DESCRIPTION OF ABBREVIATIONS GUIDE

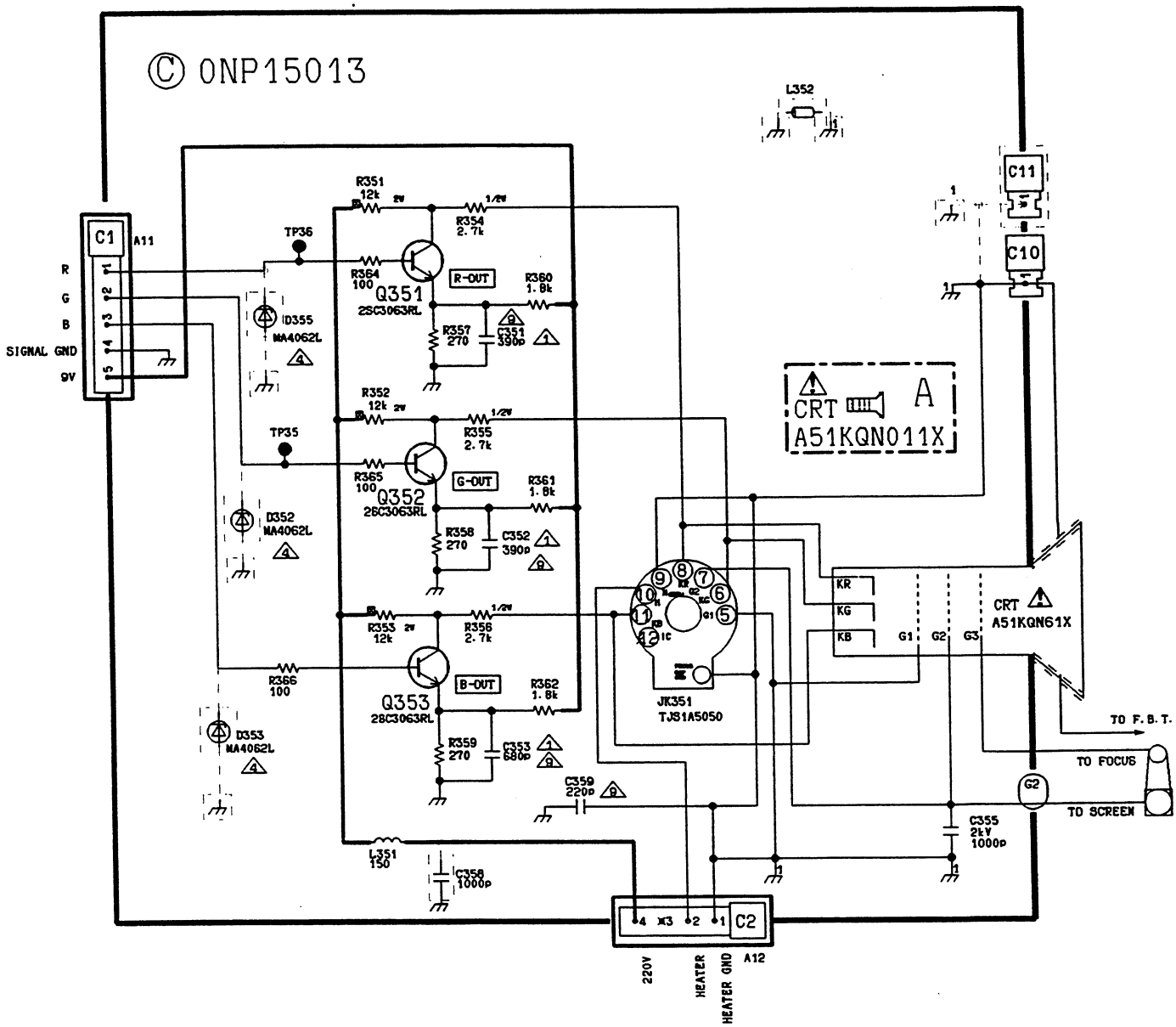
RESISTOR			
TYPE		ALLOWANCE	
C	Carbon	F	+/– 1%
F	Fuse	J	+/– 5%
M	Metal Oxide	K	+/– 10%
S	Solid	M	+/– 20%
W	Wire Wound	G	+/– 2%

RES, C 270–J–1/4

CAPACITOR			
TYPE		ALLOWANCE	
C	Ceramic	C	+/– 0.25pF
E	Electrolytic	D	+/– 0.5pF
P	Polyester	F	+/– 1pF
S	Styrol	J	+/– 5%
T	Tantalum	K	+/– 10%
		L	+/– 15%
		M	+/– 20%
		P	+100% –0%
		Z	+80% –20%

CAP, P .068UF–K–50V

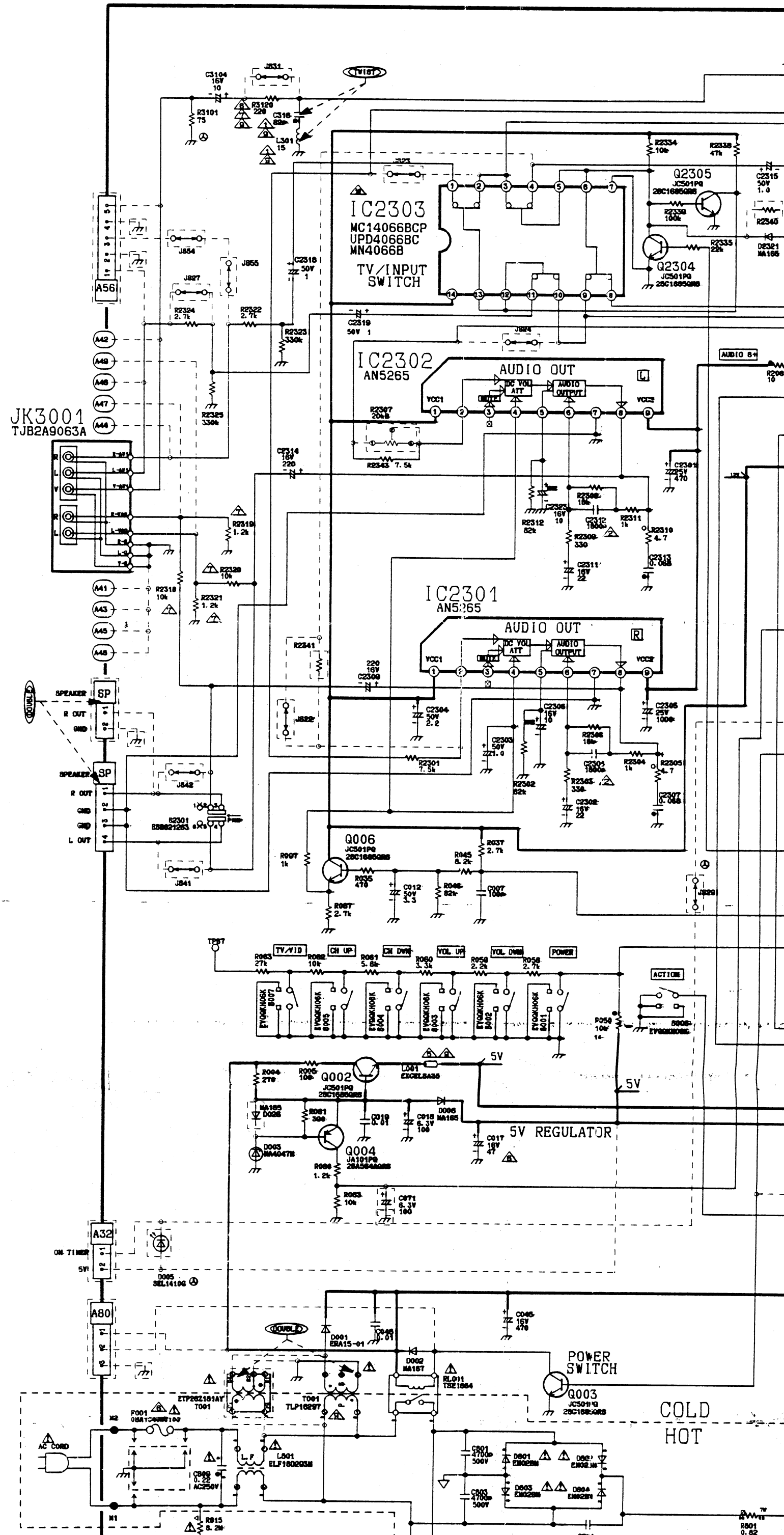
C–Board Schematic (All Models)



Voltage Chart – C–Board

Transistors

Ref.	b	c	e
Q351	2.5	149.0	2.1
Q352	2.4	152.5	2.1
Q353	2.4	156.3	2.0

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2     ********** CHECK-LIST **********   Tue May 23 13:22:54 1995

  41-49  51  56  86  97-98
  12-14  17-19  21-26  28  31-33  35-37  45-46  55-56  60-64
11  113-116  123  147  151-154  201-204  206-207  301-306
313  316  401-405  431-441  485  501-511  515  531-532  541
 554-556  567-569  582-586  572-577  601-605  606-607  801
309  812  847-849  861-862  864  866  2201-2221  2301-2309
  2310-2316  2325  2401-2406  3104
 22  25-26  109  343  451-453  455  501  531-532  542-543
557  561-565  601-605  2321

 21  23-26  104  105  105-106  111  201  301  541  551-553
301  801

 15  306-309  451-455  501  541  551  2304-2306
  13  18-22  26  30-31  35  37  45-46  50  57-63  66  71-76
  85-86  91-96  97  102-107  110-112  151-152  201-204  206
304-307  311  317-320  324  326-326  332  339  401-402  404
408-407  470-472  501-512  516-517  531-534  536-539  541-542
 551-556  562-563  565  601-602  604-619  801-805  807-808
315-316  2301-2313  2216  2219-2223  2226  2228  2257  2245
  2301-2302  2305-2306  2314-2315  2338-2341  2343  2451-2455
1  3130

2  551  501A
2  201  504  601

 451  561-562  801  1051  2201  2301-2303  2451

 24  27-29  31  37-39  41-48  58-60  64  66-70  73
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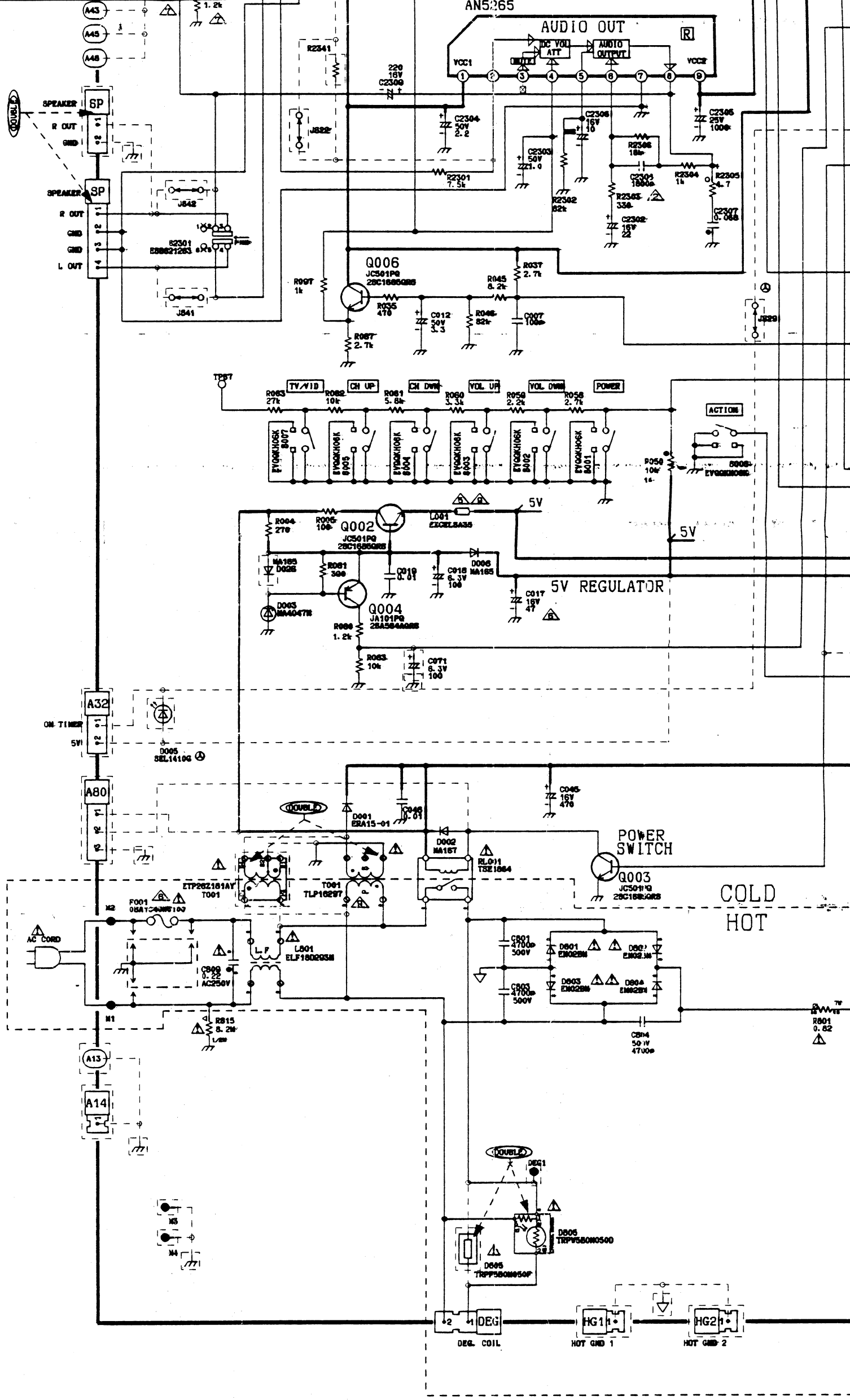


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2     **********  CRNO-LIST  **********    Tue May 23 13:22:54 1995

 41-49  51  56  86  97-98
 12-14  17-19  21-25  28  31-33  35-37  45-46  55-56  60-64
11  113-116  125  147  151-154  201-204  206-207  301-306
313  316  401-405  451-461  466  501-511  515  531-532  541
554-556  567-587  589-670  672-677  681-685  696-697  801
809  812  867-868  881-882  884  956  2201-2221  2301-2309
  2316-2318  2325  2401-2406  3104
 22  25-29  106  303  451-453  455  501  531-532  542-543
557  561-565  604-606  2321

 21  23-25  104  105  106-126  111  201  301  541  551-553
601  661

 15  306-308  451-456  501  541  551  2304-2306
  13  18-22  26  30-31  35  37  45-46  56  57-63  65  71-78
  85-89  91-96  97  102-107  110-112  151-152  201-204  206
304-307  311  317-320  324  326-326  332  339  401-402  404
406-407  470-472  561-612  516-617  531-534  536-539  541-542
 551-556  562-563  566  601-602  604-619  661-665  807-808
315-316  2201-2213  2216  2219-2225  2228  2226  2257  2245
  2301-2540  2306-2325  2334-2336  2338-2341  2343  2451-2455
1  3120

2  551  501A
2  201  606  661

 451  561-562  841  1661  2201  2301-2303  2451

-24  27-29  31  37-39  41-42  52-60  64  68-70  73

14  16  21-22  51-54  476  476  479

10-11  14-16

R

TS NO.
  TYP06661ADB  TXAWC01AAL  TXAWC02ZAR  TXAWC364DA

3-3  D603-R  R668-1  FBT-10  T001-P3  RL001-2  R801-R  C585-L
-L  L562-L  C588-L  FBT-6  R602-3  D803-L  R863-R  C569-L  Q561-C
5-1  R511-L  IC801-2  R681-L  T001-P1  D804-R  C805-R  C584-1
-R  D801-R  C868-L  L564-R  L861-3  D602-L  FBT-8  C569-R  L551-L
1-1  C564-2  R810-L  FBT-11  Q651-E  T001-3  IC861-3  D561-L
0-R  FBT-3  D881-L  FBT-4  D564-R  D602-R  L861-1  FBT-5  C563-1
9-R  L861-2  R888-R  RL001-1  D564-L  C565-L  D561-R  Q551-B
01-4

                                    Total Error Count(8) = 20
8 >>>
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    2421203          |nvalid CRNO
    2424578          |nvalid CRNO
    2424672          |nvalid CRNO
    2421309          Duplicate CRNO
    2431310          Duplicate CRNO
    2424675          |nvalid CRNO
    2421700          Duplicate CRNO
    2421470          Duplicate CRNO
    2431466          |nvalid CRNO
    2420965          Duplicate CRNO
    2420965          |nvalid CRNO
    2420694          Duplicate CRNO
    2421546          Duplicate CRNO
    2421546          |nvalid CRNO
    2421546          Duplicate CRNO
    2431376          |nvalid CRNO
    2420708          Duplicate CRNO
    2420708          Duplicate CRNO
    2420707          Duplicate CRNO
    2421607          |nvalid CRNO
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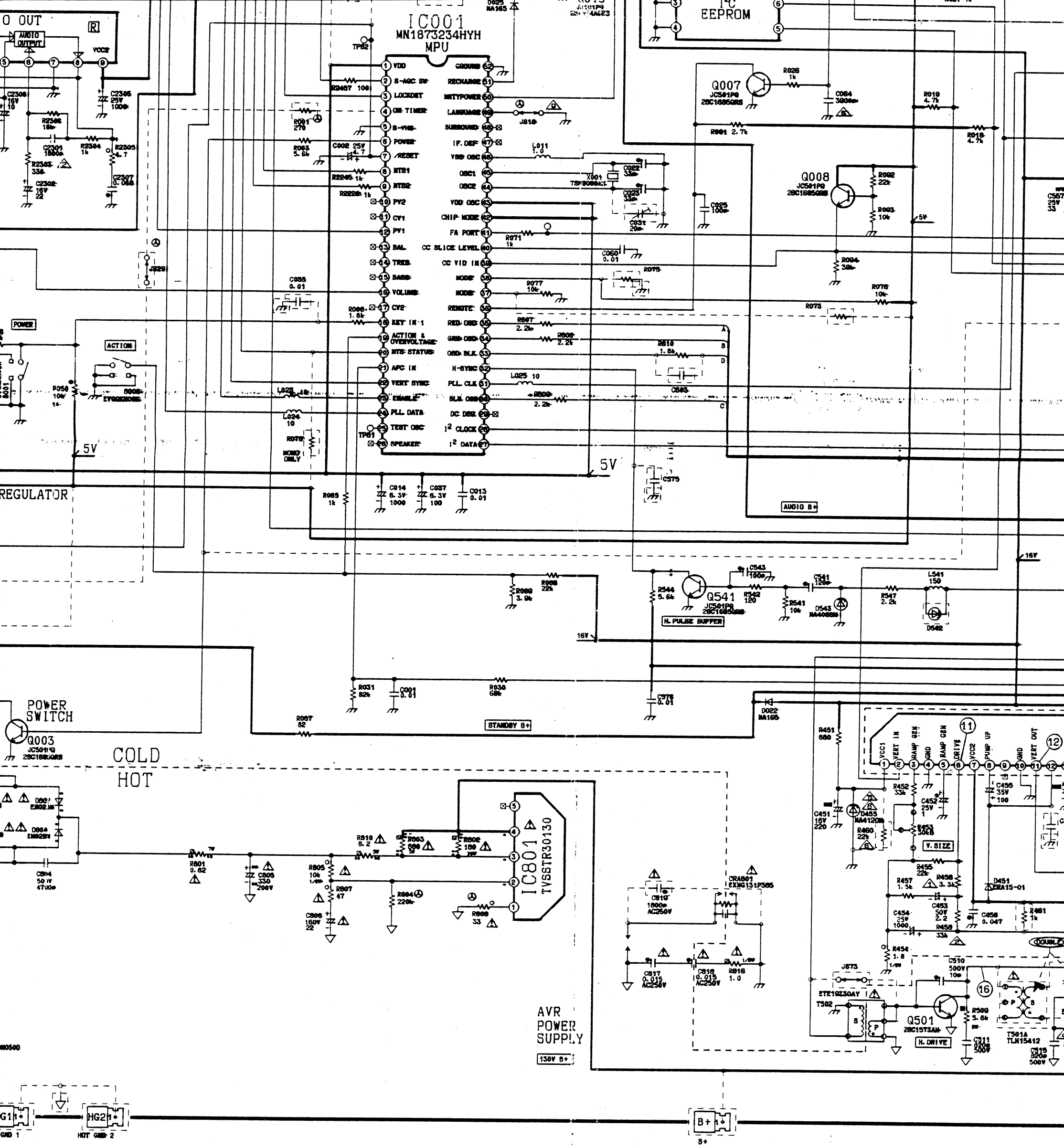
CRNO	0NP190022AA	0NP190022BA	0NP190022ZA	REASON OF APPLI.
D005	NIL	NIL	SEL1410G	
JS29	NIL	NIL	03A506022	
R001	NIL	NIL	ERDS2TJ271T	
JB18	03A505017.H9	NIL	03A505017.H9	ENGLISH/SPANISH



IMPORTANT SAFETY NOTICE

THIS SCHEMATIC DIAGRAM INCORPORATES SPECIAL FEATURES THAT ARE IMPORTANT FOR PROTECTION FROM X-RADIATION, FIRE AND ELECTRICAL SHOCK HAZARDS. WHEN SERVICING IT IS ESSENTIAL THAT ONLY MANUFACTURERS SPECIFIED PARTS BE USED FOR THE CRITICAL COMPONENTS DESIGNATED WITH A ⚠ IN THE SCHEMATIC.

	APPLIED MODEL			
SUB ASSEMBLY PART NO.	MODEL NO.	PLANNING NO.	PRODUCTION START	
ONP190022	GENERIC			
ONP190022AA	CT-20G20T	5DB		A
ONP190022AA	CT-20G20T-1	5DB		B
ONP190022BA	CT-20G20CT	5DU		A
ONP190022BA	CT-20G20CT-1	5DU		B
ONP190022ZA	CT-20G30T	5DV		A
ONP190022ZA	CT-20G30T-1	5DV		B
ONP190022ZA	CT-21G30RT	5DW		

A51 REMOTE GND 5V

IC2451 AN5285K

L-IN · LEVEL SENSOR 1 · L-OUT · VCC · V-REF · GND · AGC ON/OFF · R-OUT · LEVEL SENSOR 2 · R-IN

REMOTE RECEIVER

IC1051 PIC-12643SP

IC552 AN78L12

IC003 MN1280

IC002 24LC02BIP I²C EEPROM

IC001 MN1873234HYH MPU

VDD · S-AGC SW · LOCKDET · OSD TIMER · S-VHS · POWER · /RESET · MTS1 · MTS2 · PV2 · CV1 · PV1 · BAL · TREB · BASS · VOLUME · CV2 · KEY IN 1 · ACTION & OVERVOLTAGE · MTS STATUS · AFC IN · VERT SYNC · ENABLE · PLL DATA · TEST OSC · SPEAKER

GROUND · RECHARGE · MNTYPOWER · LANGUAGE · SURROUND · IF DEF · VSS OSC · OSC1 · OSC2 · VDD OSC · CHIP MODE · FA PORT · CC SLICE LEVEL · CC VID IN · MODE · MODE · REMOTE · RED OSC · GRN OSC · OSD BLK · H-SYNC · PLL CLK · BLK OSC · DC DEF · I² CLOCK · I² DATA

Q2305 JC501PQ 2SC1685QRS

Q2304 JC501PQ 2SC1685QRS

Q007 JC501PQ 2SC1685QRS

Q008 JC501PQ 2SC1685QRS

Q015 JC501PQ 2SC1685QRS

Q541 JC501PQ 2SC1685QRS

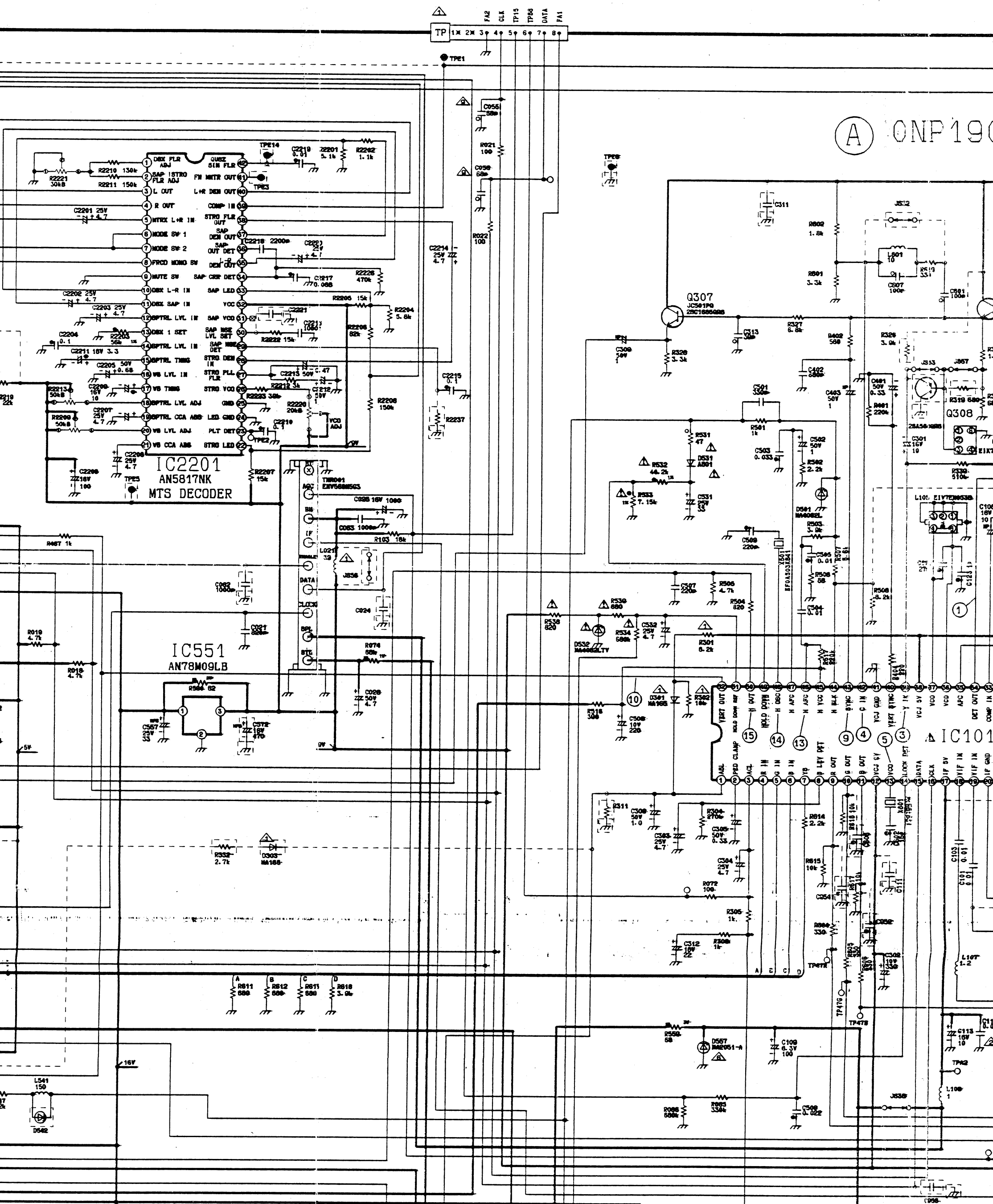
D2321 MA165 · D025 MA165 · D022 MA165 · D455 MA4120M · D543 MA4068M · D542

IC2201 AN5811 MTS DE

DBX FLR ADJ · SAP ISTRO FLR ADJ · L OUT · R OUT · NTRX L+R IN · MODE SW 1 · MODE SW 2 · FRCD MONO · MUTE SW · DBX L-R IN · DBX SAP IN · SPTRL LVL · DBX 1 SET · SPTRL LVL · SPTRL TMNG · VB LVL IN · VB TMNG · SPTRL LVL · SPTRL CCA · VB LVL ADJ · VB CCA ADJ

VCC1 · VERT IN · RAMP GEN · GND · RAMP GEN · DRIVE · VCC2 · PUMP UP · GND · VERT OUT

AUDIO B+ · STANDBY B+ · H. PULSE BUFFER · V. SIZE · ACTION · POWER SWITCH · COLD · HOT · MONO ONLY · 5V · 16V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FA2 CLK TP15 TP88 DATA FA1
TPE1
TPE14
TPE3
TPE2
TPE5
TPE6
C2219 0.01
C2201 5.1k
R2202 1.1k
R2221 30kB
R2210 130k
R2211 150k
C2201 25V 4.7
C2202 25V 4.7
C2203 25V 4.7
C2204 0.1
C2211 16V 3.3
C2205 50V 0.68
C2209 16V 10
C2207 25V 4.7
C2208 25V 4.7
C2206 16V 100
R2213 50kB
R2209 50kB
R2203 56k
R2207 15k
R2205 15k
R2204 5.6k
R2206 82k
R2208 150k
R2226 470k
C2217 0.068
C2218 2200p
C2221
C2213 50V 0.47
C2212 50V 1
R2223 39k
R2212 3k
R2220 20kB
C2210 0.1
VCO ADJ
C2215 0.1
R2237
C055 56p
R021 100
C056 68p
R022 100
C2214 25V 4.7
IC2201
AN5817NK
MTS DECODER
DEM FLR ADJ
SAP STRO FLR ADJ
L OUT
R OUT
MTRX L+R IN
MODE SW 1
MODE SW 2
FRCD MONO SW
MUTE SW
DBX L-R IN
DBX SAP IN
SPTRL LVL IN
DBX 1 SET
SPTRL LVL IN
SPTRL TMNG
VB LVL IN
VB TMNG
SPTRL LVL ADJ
SPTRL CCA ADJ
VB LVL ADJ
VB CCA ADJ
QUEZ SIN FLR
FM MTR OUT
L+R DEM OUT
COMP IN
STRO FLR OUT
SAP DEM OUT
SAP OUT DET
DEM OUT
SAP CRR DET
SAP LED
VCC
SAP VCO
SAP NSE LVL SET
SAP NSE DET
STRO DEM IN
STRO PLL FLR
STRO VCO
GND
LED GND
PLT DET
STRO LED
THR001 EXV5688G3
C086 16V 1000
C085 1000p
R103 18k
L021 33
J856
C092 1000
C021
C024
R074 68k
C020 50V 4.7
IC551
AN78M09LB
R564 82
C557 25V 47
C572 16V 470
9V
5V
16V
R467 1k
R019 4.7k
R018 4.7k
R332 2.7k
D303 MA165
L541 150
D542
A ONP190
Q307 JC501PQ 2SC1685GRB
C311
R602 1.8k
R601 3.3k
L601 10
R619 33
C607 100p
C601 100p
J852
C313
R327 6.8k
R402 560
R326 3.3k
C309 50V 1
C402 680p
C403 50V 1
C501 330p
R501 1k
R531 47
D531 A8G1
R532 44.2k
R533 7.15k
C531 25V 47
C502 50V 1
R502 2.2k
C503 0.033
D501 MA4062L
C509 220p
R503 3.9k
C505 0.01
R507 5.6k
R506 68
C504 0.01
R508 8.2k
J853
J857
C401 50V 0.33
R401 220k
R319 680
Q308
2SA56/X6B6
C301 16V 10
R339 510k
L101 EIKT0853B
C103 10 0.1
C113 16V 10
L107 1.2
TP2
L108 1
J858
C307 220p
R505 4.7k
R504 820
R539 680
R538 820
R534 680k
C532 25V 4.7
D532 MA4062LTV
R301 8.2k
D341 MA165
R342 18k
C308 10V 220
R318 330
R311
C309 50V 1.0
C303 25V 4.7
R304 270k
C305 50V P.33
C304 25V 4.7
R072 100
R305 1k
C312 16V 22
R309 1k
R614 2.2k
R615 10k
R617 10k
C354
R606 330
C352
C302 10V 330
TP476
TP478
R559 68
D557 MA2051-A
C109 6.3V 100
R086 680k
R083 330k
C508 0.022
C356
IC101
VERT OUT
HOLD DOWN
H OUT
H DRIVE
APC H
AFC H
VCO H
BLK H
SYNC
H IN
PCJ GND
VERT SYNC
V IN
VCC
APC
DET OUTPUT
GND
PEDESTAL CLAMP
AGC
R IN
G IN
B IN
BIAS
VIF AGC DET
R OUT
G OUT
B OUT
VCO
XTAL
VIF IN
IC451
LA7835-TV
V. OUT
VERT IN
RAMP GEN
GND
RAMP GEN
DRIVE
VCC2
PUMP UP
GND
VERT OUT
R452 33k
C452 25V 1
R453 30kB
V. SIZE
R455 22k
R456
C455 35V 100
C457 50V 0.1
C459
R462 47k
C461 50V 1.0
R459 1k
R463 220k
Q452 JC501PQ 2SC1685GRB
D453 MA165
R464 120k
D452 MA165
R470 15k
R471 270
C456 25V 4.7
R472 10k
R466 100
200V
Q451 JC501PQ 2SC1685GRB
AUDIO B+
D553 AU02
R553 1
C552 25V 220
C570 560p 500V
D554 AU02
C555
R611 680
R612 680
R611 680
R618 3.9k
R559 68
D557 MA2051-A
C109 6.3V 100
R086 680k
R083 330k
C508 0.022
TP476
TP478
TP482
L108 1
J856
C356
L541 150
D542
16V
5V
9V
AUDIO B+
EHT
5.6k

IC551
AN78M09LB

IC451
LA7835-TV
V. OUT

IC10

Q452 2SC1685QRS
Q451 2SC1685QRS
Q501 2SC1573AM
Q551 2SJ2060P

D451 ERA15-01
D452 MA165
D453 MA165
D501 MA165
D502
D503 MA165
D532 MA4062LTV
D551 RV2HV1
D552 AU02
D553 AU02
D554 AU02
D556 MA4360H
D557 MA2051-A
D561 AU02

T501 ETH19Y70AYN
T501A TLH15412
T551 TLF15815F2
TLF15815F

L541 150
L552 EXCELSA24
L553 EXCELSA24
L558 EXCELSA24
L551 TLH16662P
L559 EXCELSA3
L10T 1.2

J856
J858
J859
J860
J861
J862
J863
J864
J865
J866
J867
J868
J869

TP2 TP3 TP4 TP5 TP6 TP7 TP22
TP47G TP47H TP47I TP47J TP47K TP47L TP47M TP47N TP47O TP47P TP47Q TP47R TP47S TP47T TP47U TP47V TP47W TP47X TP47Y TP47Z TP48A TP48B TP48C TP48D TP48E TP48F TP48G TP48H TP48I TP48J TP48K TP48L TP48M TP48N TP48O TP48P TP48Q TP48R TP48S TP48T TP48U TP48V TP48W TP48X TP48Y TP48Z TP49A TP49B TP49C TP49D TP49E TP49F TP49G TP49H TP49I TP49J TP49K TP49L TP49M TP49N TP49O TP49P TP49Q TP49R TP49S TP49T TP49U TP49V TP49W TP49X TP49Y TP49Z TP50A TP50B TP50C TP50D TP50E TP50F TP50G TP50H TP50I TP50J TP50K TP50L TP50M TP50N TP50O TP50P TP50Q TP50R TP50S TP50T TP50U TP50V TP50W TP50X TP50Y TP50Z TP51A TP51B TP51C TP51D TP51E TP51F TP51G TP51H TP51I TP51J TP51K TP51L TP51M TP51N TP51O TP51P TP51Q TP51R TP51S TP51T TP51U TP51V TP51W TP51X TP51Y TP51Z TP52A TP52B TP52C TP52D TP52E TP52F TP52G TP52H TP52I TP52J TP52K TP52L TP52M TP52N TP52O TP52P TP52Q TP52R TP52S TP52T TP52U TP52V TP52W TP52X TP52Y TP52Z TP53A TP53B TP53C TP53D TP53E TP53F TP53G TP53H TP53I TP53J TP53K TP53L TP53M TP53N TP53O TP53P TP53Q TP53R TP53S TP53T TP53U TP53V TP53W TP53X TP53Y TP53Z TP54A TP54B TP54C TP54D TP54E TP54F TP54G TP54H TP54I TP54J TP54K TP54L TP54M TP54N TP54O TP54P TP54Q TP54R TP54S TP54T TP54U TP54V TP54W TP54X TP54Y TP54Z TP55A TP55B TP55C TP55D TP55E TP55F TP55G TP55H TP55I TP55J TP55K TP55L TP55M TP55N TP55O TP55P TP55Q TP55R TP55S TP55T TP55U TP55V TP55W TP55X TP55Y TP55Z TP56A TP56B TP56C TP56D TP56E TP56F TP56G TP56H TP56I TP56J TP56K TP56L TP56M TP56N TP56O TP56P TP56Q TP56R TP56S TP56T TP56U TP56V TP56W TP56X TP56Y TP56Z TP57A TP57B TP57C TP57D TP57E TP57F TP57G TP57H TP57I TP57J TP57K TP57L TP57M TP57N TP57O TP57P TP57Q TP57R TP57S TP57T TP57U TP57V TP57W TP57X TP57Y TP57Z TP58A TP58B TP58C TP58D TP58E TP58F TP58G TP58H TP58I TP58J TP58K TP58L TP58M TP58N TP58O TP58P TP58Q TP58R TP58S TP58T TP58U TP58V TP58W TP58X TP58Y TP58Z TP59A TP59B TP59C TP59D TP59E TP59F TP59G TP59H TP59I TP59J TP59K TP59L TP59M TP59N TP59O TP59P TP59Q TP59R TP59S TP59T TP59U TP59V TP59W TP59X TP59Y TP59Z 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TP66K TP66L TP66M TP66N TP66O TP66P TP66Q TP66R TP66S TP66T TP66U TP66V TP66W TP66X TP66Y TP66Z TP67A TP67B TP67C TP67D TP67E TP67F TP67G TP67H TP67I TP67J TP67K TP67L TP67M TP67N TP67O TP67P TP67Q TP67R TP67S TP67T TP67U TP67V TP67W TP67X TP67Y TP67Z TP68A TP68B TP68C TP68D TP68E TP68F TP68G TP68H TP68I TP68J TP68K TP68L TP68M TP68N TP68O TP68P TP68Q TP68R TP68S TP68T TP68U TP68V TP68W TP68X TP68Y TP68Z TP69A TP69B TP69C TP69D TP69E TP69F TP69G TP69H TP69I TP69J TP69K TP69L TP69M TP69N TP69O TP69P TP69Q TP69R TP69S TP69T TP69U TP69V TP69W TP69X TP69Y TP69Z TP70A TP70B TP70C TP70D TP70E TP70F TP70G TP70H TP70I TP70J TP70K TP70L TP70M TP70N TP70O TP70P TP70Q TP70R TP70S TP70T TP70U TP70V TP70W TP70X TP70Y TP70Z TP71A TP71B TP71C TP71D TP71E TP71F TP71G TP71H TP71I TP71J TP71K TP71L TP71M TP71N TP71O TP71P TP71Q TP71R TP71S TP71T TP71U TP71V TP71W TP71X TP71Y TP71Z TP72A TP72B TP72C TP72D TP72E TP72F TP72G TP72H TP72I TP72J TP72K TP72L TP72M TP72N TP72O TP72P TP72Q TP72R TP72S TP72T TP72U TP72V TP72W TP72X TP72Y TP72Z TP73A TP73B TP73C TP73D TP73E TP73F TP73G TP73H TP73I TP73J TP73K TP73L TP73M TP73N TP73O TP73P TP73Q TP73R TP73S TP73T TP73U TP73V TP73W TP73X TP73Y TP73Z TP74A TP74B TP74C TP74D TP74E TP74F TP74G TP74H TP74I TP74J TP74K TP74L TP74M TP74N TP74O TP74P TP74Q TP74R TP74S TP74T TP74U TP74V TP74W TP74X TP74Y TP74Z TP75A TP75B TP75C TP75D TP75E TP75F TP75G TP75H TP75I TP75J TP75K TP75L TP75M TP75N TP75O TP75P TP75Q TP75R TP75S TP75T TP75U TP75V TP75W TP75X TP75Y TP75Z TP76A TP76B TP76C TP76D TP76E TP76F TP76G TP76H TP76I TP76J TP76K TP76L TP76M TP76N TP76O TP76P TP76Q TP76R TP76S TP76T TP76U TP76V TP76W TP76X TP76Y TP76Z TP77A TP77B TP77C TP77D TP77E TP77F TP77G TP77H TP77I TP77J TP77K TP77L TP77M TP77N TP77O TP77P TP77Q TP77R TP77S TP77T TP77U TP77V TP77W TP77X TP77Y TP77Z TP78A TP78B TP78C TP78D TP78E TP78F TP78G TP78H TP78I TP78J TP78K TP78L TP78M TP78N TP78O TP78P TP78Q TP78R TP78S TP78T TP78U TP78V TP78W TP78X TP78Y TP78Z TP79A TP79B TP79C TP79D 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A97 A98 A99

TO CRT ANODE EHT
TO CRT FOCUS
TO CRT SCREEN

APPLIED MODEL				
DEL NO.	PLANNING NO.	PRODUCTION START	FRAME (ISLAND)	CHG NO.
20T	5DB		A	
20T-1	5DB		B	H13
20GT	5DU		A	H9
20GT-1	5DU		B	H13
30T	5DV		A	
30T-1	5DV		B	H13
30RT	5DW			

CHG NO.	CIRCUIT NO.	DATE	CHANGE	EFF.
H1				Y
H2				N
H3				Y
H4				Y
H5				Y
H6				Y
H7				Y
H8				Y
H9				Y
H10				Y
H11				Y
H12				Y
H13				Y
H14				Y

IC101 AN5163K

PCB NAME	0NP190022
PRINT TOOL NO.	0NP190022-9
COMB. PCB PARENT NO.	
CHASSIS	NA3C
BOARD	A
DESIGNED BY	T. ZELLER
CHECKED BY	M. TSUNEI
APPROVED BY	K. MURAMATSU

NA3C A

APPLICATION	AA
SAVED DATE	1996/06/02
SHEET	0MP190022. A-8
GROUP	MTC
USER	JIM

A ONP190022

TP15 TP68 DATA FA1

IC101 AN5163K

Q307 JC501PQ 2SC1685QRS

Q306 JC501PQ 2SC1685QRS

Q308 2SA56

X102 EFCS4504AB

X201 EFCS4053B49

X101 EFCH45MVK12B

L103 EIV7EB041B

L105 EIV7EB053B

LC301 EIX7EB0020

L201 EIS7EB0048

L003 EXCELSA39

D531 A801

D532 MA4062LTV

D561 MA4062L

D557 MA2051-A

D341 MA165

X501 EFOA503K041

TP12 TP21 TP16 TP14 TP47G TP47B TP47R TP42 TPA1 TPA10

J552 J553 J557 J558 J559 J560

E-E C-C B-B

RF AGC

MONO ONLY STEREO ONLY

AUDIO B+

EHT

SIGNAL GND 9V 5V

A11 C1

ORDER NO.
MTC9504597F1
B5

Service Manual

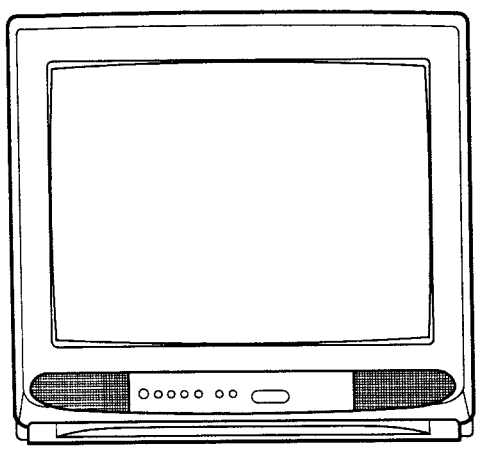
Supplement

PANA-07771

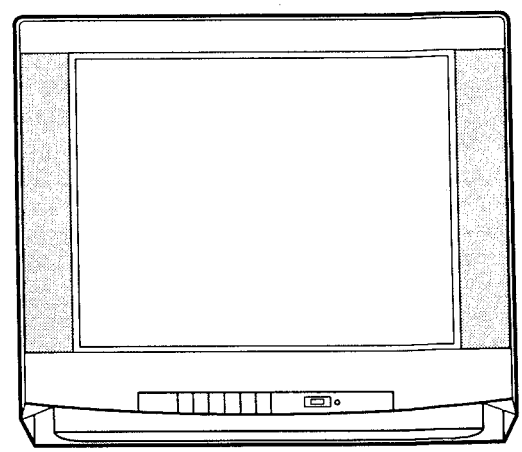
Color Television

Models	Chassis
CT–20G20T	AEDP257
CT–20G20T–1	AEDP257
CT–20G20CT	AMEDP257
CT–20G20CT–1	AMEDP257
CT–20G30T	ALEDP257
CT–20G30T–1	ALEDP257

(NA3C)



CT–20G20T/–1 & CT–20G20CT/–1



CT–20G30T/–1

For service information on Models CT–20G20T/–1 / CT–20G20CT/–1 and CT–20G30T/–1 please file and use this Supplemental Service Manual together with the Simplified Service Manual, Order No. MTC9504596F1.

Included in this Suplemental Service Manual are Adjustment Procedures, Flow charts and Block Diagrams.

NOTE: The Service Technician is required to read and follow the "Safety Precautions" and "Important Safety Notice" in this manual.

"WARNING! This Service Manual is designed for experienced repair technicians only and is not designed for use by the general public. It does not contain warnings or cautions to advise non–technical individuals of potential dangers in attempting to service a product. **Products powered by electricity shouldbe serviced or repaired only by experienced professional technicians.** Any attempt to service or repair the product or products dealt with in this Service Manual by anyone else could result in serious injury or death."

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7771

Important Safety Notice

There are special components used in this television set which are important for safety. These parts are identified on the schematic diagram by the symbol ⚠ and printed in **BOLD TYPE** on the replacement parts list. It is essential that these critical parts should be replaced with manufacturer's specified parts to prevent X–RADIATION, shock, fire or other hazards. Do not modify the original design without the permission of manufacturer.

Safety Precautions

General Guidelines

An ISOLATION TRANSFORMER should always be used during the servicing of a receiver whose chassis is not isolated from the AC power line. Use a transformer of adequate power rating as this protects the technician from accidents resulting in personal injury from electrical shocks. It will also protect the receiver and its components from being damaged by accidental shorts of the circuitry that may be inadvertently introduced during the service operation.

When servicing observe the original lead dress, especially in the high voltage circuit. In case of a short circuit, replace every part which has overheated.

Always REPLACE PROTECTIVE DEVICES, such as fishpaper, isolation resistors and capacitors and shields after working on the receiver. Use only manufacturers recommended rating for fuses, circuit breakers, etc.

High potentials are present when this set is operating. Operation of the set without the rear cover involves the danger of electric shock from the set's power supply. Servicing should not be attempted by anyone who is not thoroughly familiar with the precautions necessary when working on high–voltage equipment.

Extreme care should be used in HANDLING THE PICTURE TUBE. Rough handling may cause it to implode due to atmospheric pressure (14.7 lbs per sq. in.). Do not nick or scratch the glass or subject it to any undue pressure in removal or installation. When handling, use safety goggles and heavy gloves for protection. Discharge picture tube by shorting the anode connection to chassis ground (not cabinet or other mounting parts). When discharging, go from cold ground (i.e. dag ground lead) to anode with a well insulated piece of wire.

Avoid prolonged exposure at close range to unshielded areas of the picture tube. Possible danger of personal injury from unnecessary exposure to X–ray radiation may result.

The TEST PICTURE TUBE used for servicing the chassis at the bench should incorporate a safety glass and magnetic shield. The safety glass affords shielding from the tube viewing area against X–ray radiation as well as implosion protection. The magnetic shield limits X–ray radiation around the bell of the picture tube in addition to restricting magnetic effects. When using a picture tube test jig for service, ensure that jig is capable of handling 31kV without causing X–radiation.

BEFORE RETURNING A SERVICED RECEIVER **(of any type)** TO THE OWNER, the service technician must thoroughly test the unit to be certain that it is completely safe to operate without danger of electrical shock. DO NOT USE A LINE ISOLATION TRANSFORMER WHEN MAKING THIS TEST.

Leakage Current Cold Check

Unplug the AC cord and connect a jumper between the two plug prongs.

Measure the resistance between the jumpered AC plug and each exposed metallic part such as screwheads, antenna terminals, control shafts, etc. If the exposed metallic part has a return path to the chassis, the reading should be between 240kΩ and 5.2MΩ. When the exposed metal does not have a return path to the chassis, the reading must be infinite.

Leakage Current Hot Check (See Figure)

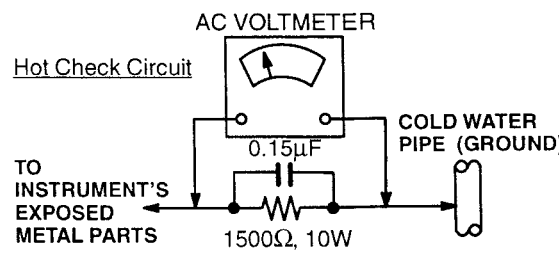
Plug the AC cord directly into the AC outlet. Do not use an isolation transformer during the check.

Connect a 1.5kΩ 10 watt resistor in parallel with a 0.15μF capacitor between each exposed metallic part and ground. Use an earth ground, for example a water pipe.

Using an AC voltmeter with 1000 ohms/volt or more sensitivity, measure the potential across the resistor.

Move the resistor connection to each exposed metallic part and measure the voltage present.

Check that any potential does not exceed 0.75 volt RMS. A leakage current tester (Simpson Model 229, Sencore Model PR57 or equivalent) may be used in the above hot check, in which case any current measure must not exceed 1/2 milliamp. In case any measurement is out of the limits specified, there is a possibility of a shock hazard and the set must be repaired and rechecked before it is returned to the customer.



X–Radiation

WARNING: The potential source of X–radiation in TV sets is the High Voltage section and the picture tube.

NOTE: It is important to use an accurate, periodically calibrated high voltage meter.

Adjust BRIGHTNESS, PICTURE, SHARPNESS and COLOR controls to Minimum.

Measure the High Voltage. The high voltage meter should indicate 28.75kV ±1.25kV. If the upper meter indication is out of tolerance, immediate service and correction is required to insure safe operation and to prevent the possibility of premature component failure.

Horizontal Osc. Disable Circuit Test

This test must be made as a final check before the set is returned to the customer. See HORIZONTAL OSC. DISABLE CIRCUIT PROCEDURE CHECK in this manual.

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Refer to the Simplified Service Manual, Order No. MTC9504596F1 for Parts List, C–Board Schematics, and Separate Large Pullout Schematic Sheet with A–Schematics, Waveforms, Notes & Voltage Charts.

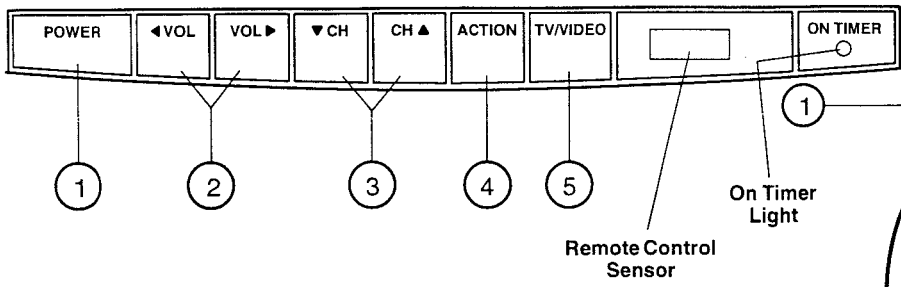
Specifications

Power Source:	120 volts, 60 Hz, AC
Power Consumption:	1.7 amps Max.
Antenna Terminal Impedance:	1–UHF/VHF 75Ω input
Channel Capability:	181 Channels Phase 18M Synthesizer
Off the Air:	VHF 2~13, UHF 14~69
Cable:	125 Channels
Video Input Jack:	1V p–p 75Ω, phono jack type
Audio Input Jack:	500mV RMS, High impedance 10k
Audio Out/Variable:	0~1V. RMS, 10K (30% Modulation)
Audio Output:	1.5Wx1.5W (10% distortion)
Comb Filter:	Separates video signal from chroma
AI Sound	Sound volume is requlated between programs and commencials to maintain a constant output level.
Closed Caption Viewing:	Built in Closed Caption Decoder provides a visual depiction of information contained in the audio portion of a television program.
Menu:	Easicon Menu System
Remote Control:	Easicon (Universal) Infra–red system EUR501224
Picture Tube:	20" diagonal (viewing area) 90 degree deflection **A51KQN61X** **A51KQN011X (all –1 models)**
Anode Voltage:	30kV Max. (zero beam) 28.75kV ±1.25KV
Dimensions:	**CT–20G30T/T–1** Height – 17–13/16" (455mm) Width – 21–5/8" (549mm) Depth – 18–11/16" (475mm) **Weight:** – 52 lbs. (23.6 kg) **(All Other Models)** Height – 18–1/4" (464mm) Width – 20" (508mm) Depth – 19" (429mm) **Weight:** – 46 lbs. (20.9 kg)

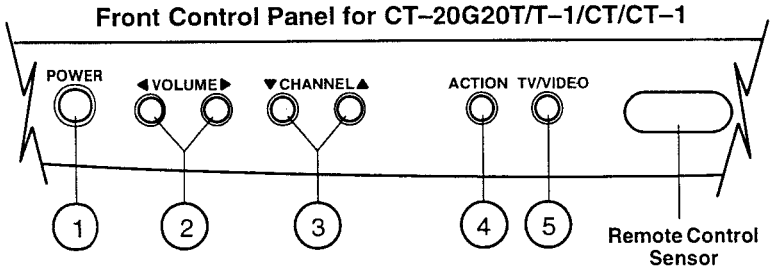
Specifications are subject to change without notice or obligation. Dimensions and weight are approximate measurements.

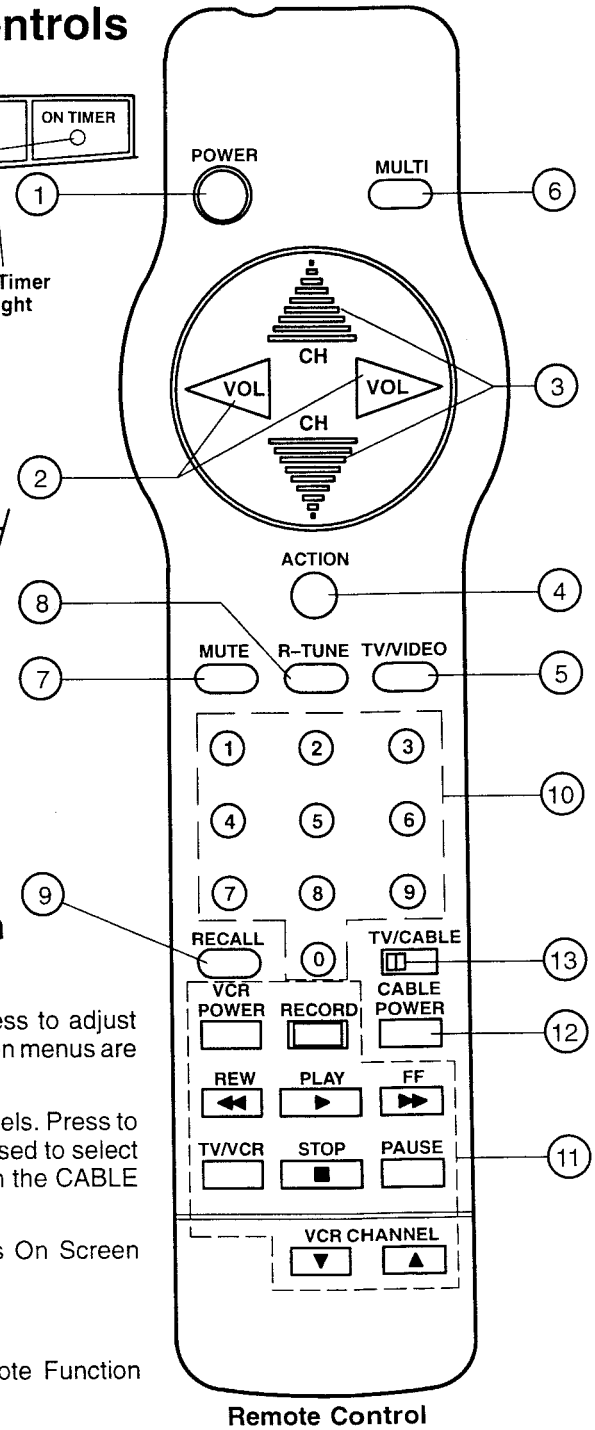
Location of Controls

Front Control Panel for CT–20G30T/T–1



Front Control Panel for CT–20G20T/T–1/CT/CT–1





Remote Control

Quick Reference Control Operation

(1) **Power Button** – Press to turn ON or OFF.

(2) **Vol (Volume) Buttons** – Press to adjust Sound Level. Press to adjust Audio Menus, Video Menus and select operating features when menus are displayed.

(3) **Ch (Channel) Buttons** – Press to select programmed channels. Press to highlight desired features when menus are displayed. Also used to select Cable Converter Box channels when TV/CABLE switch is in the CABLE position.

(4) **Action Button** – Press to display Main Menu and access On Screen feature and Adjustment Menus.

(5) **TV/Video Button** – Press to select TV or Video Input.

(6) **Multi Button** – Programmable to operate up to six Remote Function buttons.

(7) **Mute Button** – Press to mute sound. A second press returns sound.

(8) **R–Tune (Rapid Tune) Button** – Press to switch between two channels.

(9) **Recall Button** – Press to display Time, status of Sleep Timer, Channel, Video Mode, Channel Caption and Audio Mode.

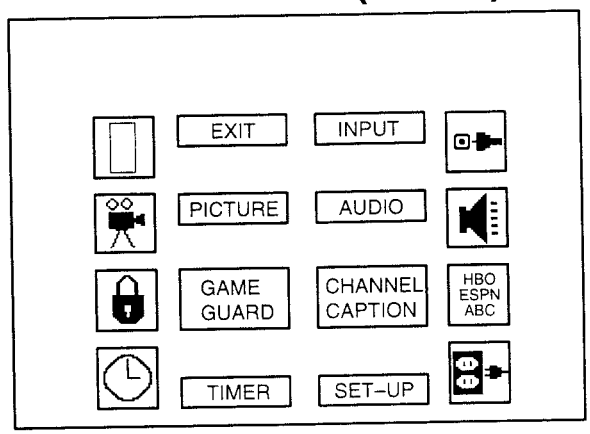
(10) **Keyboard "0 through 9" Buttons** – Press desired channel number to access any channel.

(11) **VCR Function Buttons** – Programmable to operate many brands of VCRs (TV/CABLE switch must be in TV position).

(12) **Cable Power Button** – Programmable to operate selected CATV converter boxes.

(13) **TV/Cable Switch** – This switch is used to select the proper mode when programming Remote Control Infra–Red codes or operating the TV or Cable Converter box.

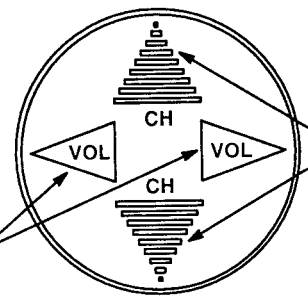
Main Menu (Icons)



Located On Remote Control

ACTION

Displays and Exits Menus



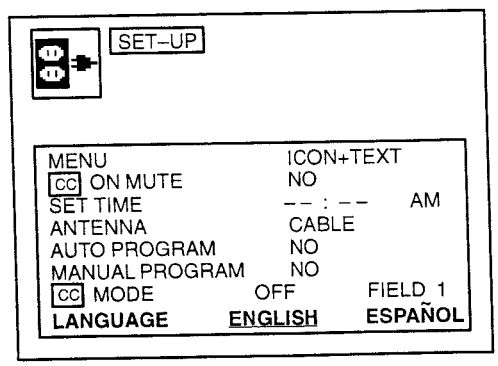
Selects Desired Feature When Menu is Displayed

Selects or Adjusts Features When Menu is Displayed

1. Press the ACTION button to display the Main Menu with Icons.
2. Press the CH UP or DOWN and the VOL LEFT or RIGHT buttons to select the desired Icon when the Main Menu is displayed (selected Icon will be indicated in Red).
3. Press the VOL buttons for left and right movement and the CH buttons for up or down movement.
4. To exit the Main Menu first select the EXIT Icon, then press the ACTION button.

The Language Menu is factory set to ENGLISH. Follow these instructions to change the Language Menu to Spanish and back to English.

1. Press the ACTION button to display the Main Menu.
2. Press the CH DOWN and VOL RIGHT buttons to select the SET–UP Icon.



3. Press the ACTION button to display the SET–UP Menu.
4. Press the CH DOWN button to select "LANGUAGE".
5. Press the VOL LEFT or RIGHT button to highlight ENGLISH or ESPAÑOL. The selected mode will be underlined.
6. Press the ACTION button twice to exit the SET–UP Menu.

Disassembly For Service

Back Cover

Remove all screws indicated by ◄ on back of set.

1. (4 screws) one at each corner.
2. 1 screw by A/V jacks.

A–Board – Main Chassis

1. Press down on locking stud located on left rail.
2. Slide chassis completely out of guide rails.
   NOTE: Some tie–wraps securing wire dressings may have to be unfastened for chassis removal.
3. Stand chassis on it's edge. Now underside is completely accessible for component removal.

C–Board – CRT Output

1. Plugs into socket on CRT neck.

Speakers

1. Secured to the front of the cabinet by 2 screws each.

Disassembly for CRT Replacement

1. Discharge CRT as instructed in Safety Precautions.
2. Disconnect yoke plug, degaussing coil plug from main board and CRT 2nd anode button.
3. Remove C–Board from CRT base and unplug black wire (CRT dag ground) C10–1 from board.
4. Disconnect plug SP from A–Board.
5. Slide main chassis assembly completely out with CRT Board and P–Board attached.

CRT Replacement

1. Perform DISASSEMBLY FOR CRT REPLACEMENT procedure.
2. Insure CRT H.V. anode button is discharged before handling CRT. See SAFETY PRECAUTIONS on handling the picture tube.
3. Remove components on CRT neck and place cabinet face down on a soft pad.
4. Note original order of CRT mounting hardware as you remove them from CRT mounting brackets at each corner of CRT.
5. Remove CRT with degaussing coil and dag ground braid attached.
6. Note original locations and mounting of degaussing coil and dag ground assembly to insure proper reinstallation on the replacement CRT.
   - **To remove degaussing coil:**
     Degaussing coil is held in place by clampers fastened to the CRT corner ears.
     These clampers must be installed onto the replacement CRT before mounting the degaussing coil.
     To remove dag ground braid:
   - Unhook coil spring from upper right CRT ear.
   - Release braid loop from lower left CRT ear.
7. Mount dag ground braid on replacement CRT. Replace degaussing coil with new ties. Dress coil as original.
8. Replace components on CRT neck and re–install into cabinet. Make sure all ground wires and circuit board plugs get connected.

Purity and Convergence Procedure

Adjustment should be necessary only if the CRT or deflection yoke is replaced or if someone has disturbed the setting. The complete procedure consists of:

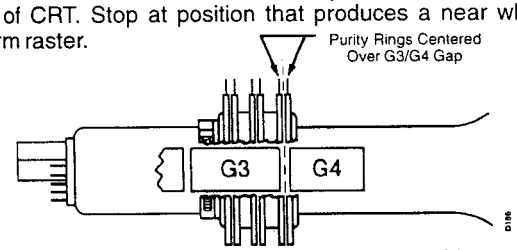
1. Initial static convergence
2. Setting purity
3. Final static convergence

When CRT or Yoke is Replaced

Place the yoke on the CRT neck (do not tighten clamp).

Position purity/convergence assembly as shown and tighten clamp snugly. Cut hot–melt glue seal on assembly and place like tabs of purity device together at 12 o'clock to reduce its magnetic field effect. Manually degauss CRT.

Turn Receiver ON and slide deflection yoke back and forth on neck of CRT. Stop at position that produces a near white, uniform raster.



Positioning of Purity/Convergence Assembly

Initial Center Static Convergence

Connect dot/crosshatch generator to Receiver and tune in signal. Observe misconvergence at center of screen only.

Adjust 4 pole magnet (center rings): separate tabs and rotate device to converge blue with red.

Adjust 6 pole magnet (rear rings): separate tabs and rotate device to converge blue and red (magenta) with green.
NOTE: Precise convergence at this point is not important.

Purity Adjustment

When in the Serviceman Mode for making electronic adjustments, Press the Remote Control (RECALL) button to enter Purity Check. (See Service Adjustments Electronic Controls.)

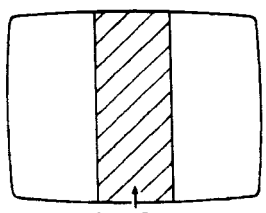
Operate the Receiver for 60 minutes using the first Purity check field (white screen) to stabilize the CRT.

Degauss the Receiver fully by using an external degaussing coil.

Press the Remote Control (RECALL) button again until the Purity Check (green screen) appears.

Loosen the deflection yoke clamp screw and move the deflection yoke back as close to the purity magnet as possible.

Adjust the front rings to set the vertical green raster precisely at the center of the screen. (Shown below.)



Green Raster

Slowly move the deflection yoke forward and adjust for the best overall green screen.

Tighten the deflection yoke clamp screw.

Press the Remote Control (RECALL) button again until the Purity Check (blue screen) and (red screen) appear and observe that good purity is obtained on each respective field.

Press the Remote Control (RECALL) button again until Purity check (white screen) appears. Observe the screen for uniform white. If not, repeat above procedure.

Final Convergence Procedure

NOTE: Before attempting convergence adjustment, vertical size and focus adjustments must be completed. Connect a dot pattern generator to the set. The brightness level should be no higher than necessary to obtain a clear pattern.

Converge the red and blue dots at the center of the screen by rotating the 4 pole (R with B) Static Convergence Magnets.

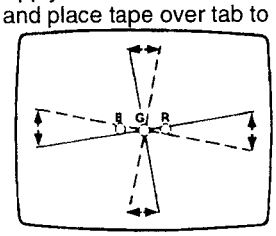
Align the converged red/blue dots with the green dots at the center of the screen by rotating the 6 pole (R/B with G) Static Convergence Magnets. Melt wax with soldering pencil to reseal magnets.

Slightly tilt (do not rotate) the deflection yoke vertically and horizontally to obtain good overall convergence.

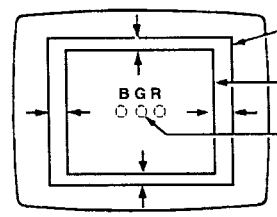
After vertical adjustment of the yoke, insert wedge at 11 o'clock position, then make the horizontal tilt adjustment.

Secure deflection yoke by inserting side two wedges at 3 and 7 o'clock positions.

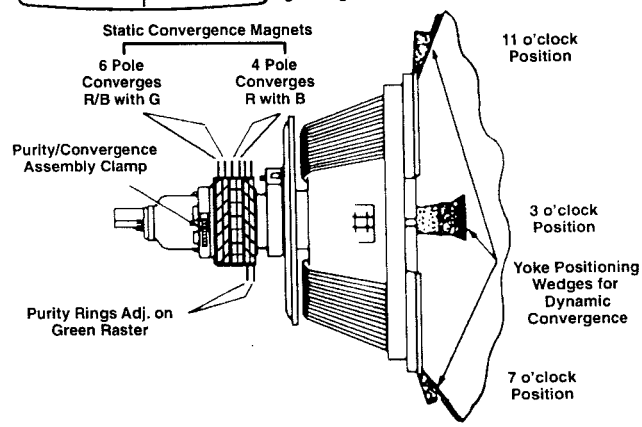
Apply adhesive between tab (thin portion) of wedge and CRT and place tape over tab to secure to CRT.



As the yoke is moved vertically, the rasters produced by the outside guns rotate in opposite directions.


B G R
Raster produced from one of the outside electron beams
Raster from the other outside electron beam
Static convergence magnets are set for center convergence

As the yoke is moved horizontally, one raster gets larger while the other gets smaller


Static Convergence Magnets
6 Pole Converges R/B with G
4 Pole Converges R with B
11 o'clock Position
Purity/Convergence Assembly Clamp
3 o'clock Position
Yoke Positioning Wedges for Dynamic Convergence
Purity Rings Adj. on Green Raster
7 o'clock Position

Permalloy Convergence Corrector Strip (Part No. OFMK014ZZ)

This strip is used in some sets to match the yoke and CRT for optimum convergence. If the yoke or CRT is replaced, the strip may not be required.

First converge the set without the strip and observe the corners.

If correction is needed:

1. Place strip between CRT and yoke, in quadrant needing correction. Slowly move it around for desired results.
2. Press adhesive tightly to the CRT and secure with tape.

Service Notes

IMPORTANT: To protect against possible damage to solid state devices due to arcing or static discharge, make certain all ground wires and CRT DAG wire are securely connected.

CAUTION: The power supply circuit is above earth ground and the chassis cannot be polarized. Use an isolation transformer when servicing to avoid damage to test equipment or chassis. Connect test equipment to correct ground (⏚) or (⏚) when servicing or incorrect readings will occur.

WARNING: This Receiver has been designed to meet or exceed applicable safety and X–radiation protection as specified by government agencies and independent testing laboratories.

To maintain original product safety design standards relative to X–radiation and shock and fire hazard, the parts indicated by the symbol ⚠ on the schematic must be replaced with identical replacement parts. Order parts from the manufacturer's parts center using numbers shown in this service manual or give complete chassis number and part reference number.

For optimum performance and reliability, all other parts should be replaced with components having identical specifications.

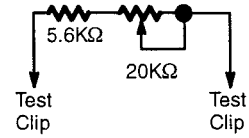
Horiz Osc Disable Circuit

This chassis employs a special circuit to protect against excessive high voltage and beam current. If for any reason the high voltage and beam current exceed a predetermined amount, this circuit operates and detunes the horizontal oscillator. This limits high voltage.

The over–voltage protection circuit is not adjustable. However, if components indicated by the symbol ⚠ on the schematic in either the horizontal sweep system or the over–voltage protection circuit itself are changed the operation of the circuit should be checked using the following procedure.

Equipment needed to check disable circuit:

1. Signal Generator with crosshatch pattern
2. Digital Voltage Meter
3. High Voltage Meter (0V–50KV)
4. Variac and Isolation Transformer
5. HHS test jig made with 20KΩ potentiometer and 5.6KΩ resistor with test clips as shown.



Preparation

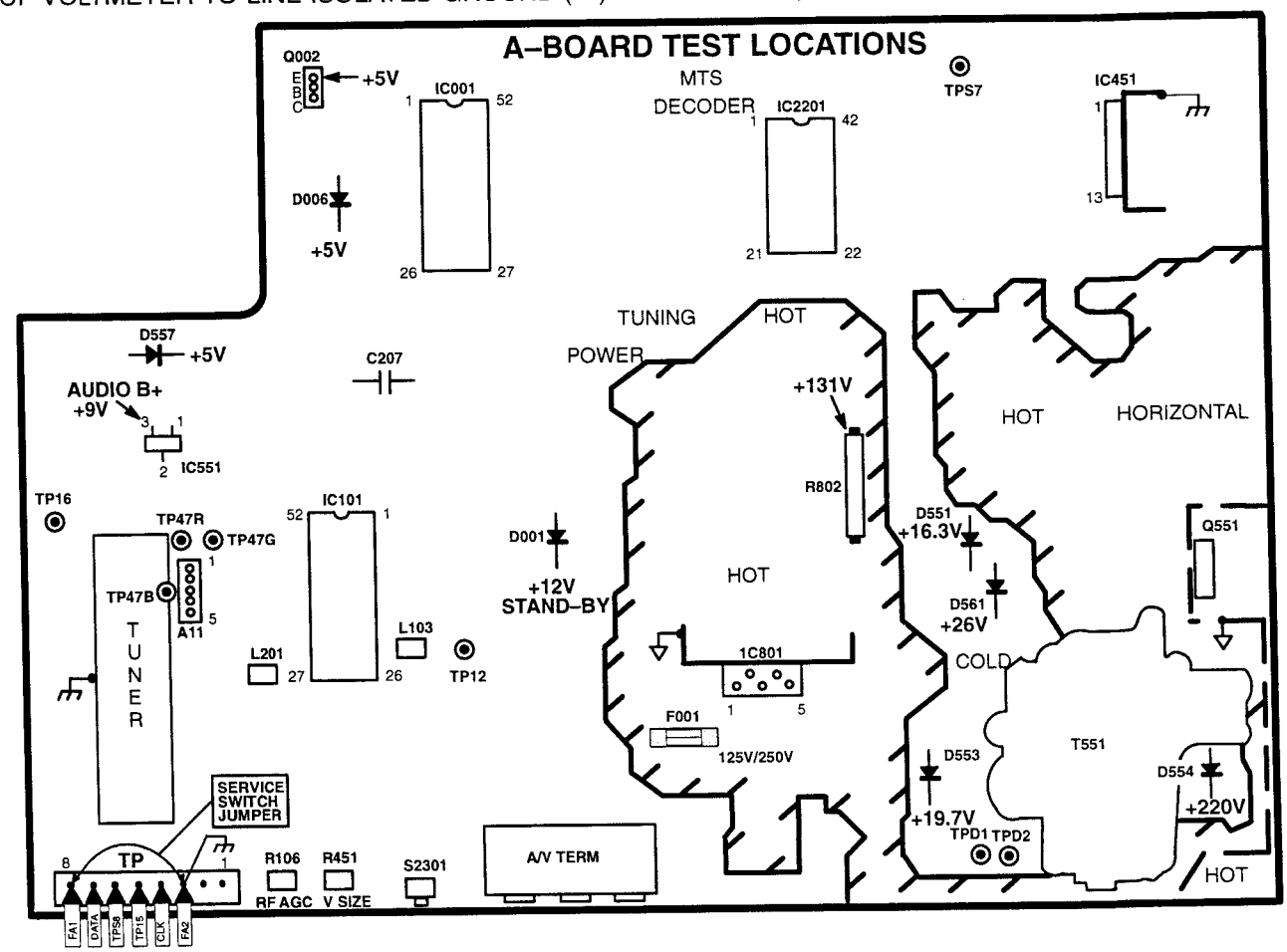
1. Connect Receiver through variac and isolation transformer to AC line. Set variac to 120V AC.
2. Obtain monoscope pattern or signal generator with crosshatch pattern.
3. Connect DVM (+) to TPD1 and (–) to TPD2 (A–Board)
4. Connect High Voltage Meter to 2nd anode under rubber cup on CRT.
5. Turn Receiver ON and confirm that horizontal is in sync.
6. Use the video menu to adjust Brightness and Picture adjustments for a DVM reading between 0.5V and 1V. (This condition exists when the crosshatch pattern is just viewable on the screen.)
7. Turn Receiver OFF. Connect the HHS test jig to IC801 Pin 1 and Pin 2. Test jig potentiometer should be set to maximum resistance.
8. Turn Receiver ON. Slowly reduce the potentiometer resistance until the horizontal just begins to pull out of sync.
9. Observe the High Voltage meter. HIGH VOLTAGE should read less than 34.2kV at point where horizontal sync is lost.
10. Turn Receiver OFF. Disconnect test jig and meter leads from chassis.

If High Voltage is not within the specified limit, the cause must be determined before the Receiver is returned to the customer.

Chassis Service Adjustment Procedures

ALL SERVICE ADJUSTMENTS ARE FACTORY PRESET AND SHOULD NOT REQUIRE ADJUSTMENT UNLESS CONTROL AND/OR ASSOCIATED COMPONENTS ARE REPLACED.

NOTE: CONNECT MINUS LEAD OF VOLTMETER TO CORRECT GROUND FOR CIRCUIT BEING CHECKED. WHEN NECESSARY TO USE A LINE OPERATED GROUND, THE GROUND INDICATION (⏚) WILL BE INDICATED. FOR THIS GROUND, USE IC801 HEAT SINK. FOR ALL OTHER CIRCUITS, CONNECT MINUS LEAD OF VOLTMETER TO LINE ISOLATED GROUND (⏚)TUNER SHIELD, IC451 HEAT SINK OR FA2.



131.0V B+ Voltage Confirmation

1. Set BRIGHT and PICTURE by using Picture Menu to Minimum.
2. Connect a DVM between R802 (IC801 pin 4 side) and Hot ground (⏚).
3. Confirm that B+ voltage is 131.0V±1.0V. This voltage supplies B+ to Horizontal Output & Flyback circuits.

Source Voltage Chart

120V AC line input. BRIGHT and PICTURE of Picture Menu adjusted to Minimum. Use cold ground (⏚) for minus lead of DVM.

Cathode of D551 (TPD9)	+16.3V ±1V
Cathode of D553	+19.7V ±2V
Cathode of D561 (TPD8)	+26.0V ±1V
Cathode of D554	+220V±15V

Adjust Picture menu for normalized video adjustments.

B+ 5V Source Voltages

Volatile 5V:

Cathode D557 = Tuner BP, IC101 (B+ V_{CC}), RF AGC (R106).

MPU 5V:

Emitter Q002 = IC001(V_{DD}), IC003.

Standby 5V:

Cathode D006 = Keyboard, IC001 (Key in 1, I^2C EEPROM (IC002)

B+ 9V Source Voltage

A11–5 (IF 9V) (VCJ 9V),Q306, Q307 (Closed Caption E.F.), Tuner (BM)

B+ 12V (Stand–by) Note: +16V when power is on

Cathode D001 = RL001 (on–off relay), Q002 (+5V Reg), IC101 (Horiz. Vcc).

High Voltage Check

1. Select an active TV channel and confirm that horizontal is in sync.
2. Adjust Brightness and Picture using Picture Icon menu so video just disappears.
3. Confirm B+ 131V is within limit.
4. Using a calibrated high voltage meter confirm that High Voltage is 28.75kV ±1.25kV.

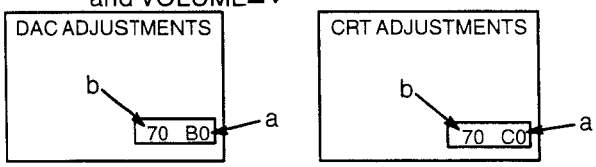
Serviceman Mode (Electronic Controls)

This chassis has new electronic technology using the I^2C Bus Concept.The system usually performs as a control function and replaces many of the required mechanical controls. Instead of adjusting various mechanical controls individually, many of the control functions are now performed electronically by using "On Screen Menu". (The Serviceman Adjustment Mode.)

NOTE: It is suggested that a serviceman read all the way through and understand the following procedure for Entering/Exiting the Serviceman Adjustment Mode; then proceed to follow the instructions working with the Receiver. After a person is familiar with this adjustment procedure, use the Instructional Flow Chart for Serviceman Mode as a quick guide.

Entering Serviceman Mode:

1. While the Receiver is ON and operating in Normal Mode, momentarily short test point FA1 to cold ground (⏚) FA2. (connector TP pin 8 to pin 3 in some models)
   "The Receiver enters the Aging Mode".
   The yellow letters "CHK" appears in the upper left corner of the CRT.
   (The VOLUME UP/DOWN will adjust rapidly.)
2. **Press** ACTION button and VOLUME UP button on Receiver Control Panel simultaneously.
   "The Receiver enters the Servicemans Mode".
   The letters "CHK" turn red.
   (The VOLUME UP/DOWN will adjust normally.)
   (All customer controls are set to a nominal level.)
3. **Press** the POWER button on the Remote Control to select one of three Serviceman Adjustment Modes.
   - B = Serviceman DAC ADJUSTMENTS
   - C = Serviceman CRT ADJUSTMENTS
   - "CHK" = Normal operation of CHANNEL ▲▼ and VOLUME▲▼



An Address Menu appears in the bottom right hand corner of the screen.

For DAC Adjustments:

a.) Press CHANNEL UP/DOWN or DIAMOND UP/DOWN on the Remote Control to select any of 6 Service Adjustment Addresses.

Important Note: Write down the original value (b in detail) for each address adjustment before adjusting anything. It is easy to adjust the wrong item.

b.) Press VOLUME UP/DOWN or DIAMOND RIGHT/LEFT on the Remote Control to adjust the level of the selected Service Adjustment.

B0 = Sub Bright
↓
B1 = Sub Color
↓
B2 = Sub Tint
↓
B3 = Sub Picture
↓
B4 = Video Det. Level
↓
B5 = Sound Output
↓
B6 = MPU Adj.

Adjustment Range and Default level values for Service Adj.

Service Adjustment	Adj Range	Default Level
Sub Bright (BO)	0 ~ 127	97
Sub Color (B1)	0 ~ 63	31
Sub Tint (B2)	0 ~ 63	33
Sub Picture (B3)	0 ~ 63	21
Video Detector Level (B4)	0 ~ 15	8
Sound Out (B5)	0 ~ 15	8
MPU Adj. (B6)	0 ~ 255	128

Press the POWER button on the Remote Control to select Serviceman CRT Adjustment Mode.

For CRT Adjustments:

a.) Press CHANNEL UP/DOWN or DIAMOND UP/DOWN on the Remote Control to select any of 6 Service Adjustments.

Important Note: Write down the original value (b in detail) for each address adjustment before adjusting anything. It is easy to adjust the wrong item.

b.) Press VOLUME UP/DOWN or DIAMOND RIGHT/LEFT on the Remote Control to adjust the level of the selected Service Adjustment.

C0 = Horiz. Center
↓
C1 = RED Cutoff
↓
C2 = GRN Cutoff
↓
C3 = BLU Cutoff
↓
C4 = RED Drive
↓
C5 = BLU Drive

Adjustment Range and Default level values for Service Adj.

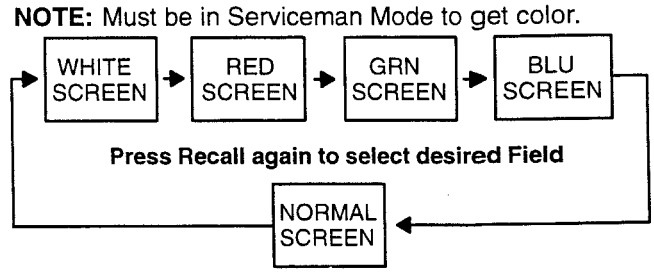
CRT Adjustment	Adj Range	Default Level
Horiz Centering (C0)	0 ~ 15	8
RED Cutoff (C1)	*0 ~ 511	128
GRN Cutoff (C2)	*0 ~ 511	128
BLU Cutoff (C3)	*0 ~ 511	128
RED Drive (C4)	0 ~ 255	128
BLU Drive (C5)	0 ~ 255	128

*Adjustment indicated in 2 steps (0 ~ 255) ➡(1 ~ 255)

To Check Purity:

Press the RECALL button on the Remote Control when in the B or C DAC Adjustment to enter Purity Field Check Mode.

NOTE: Must be in Serviceman Mode to get color.



IMPORTANT NOTE:
Always Exit Serviceman Mode After Use.

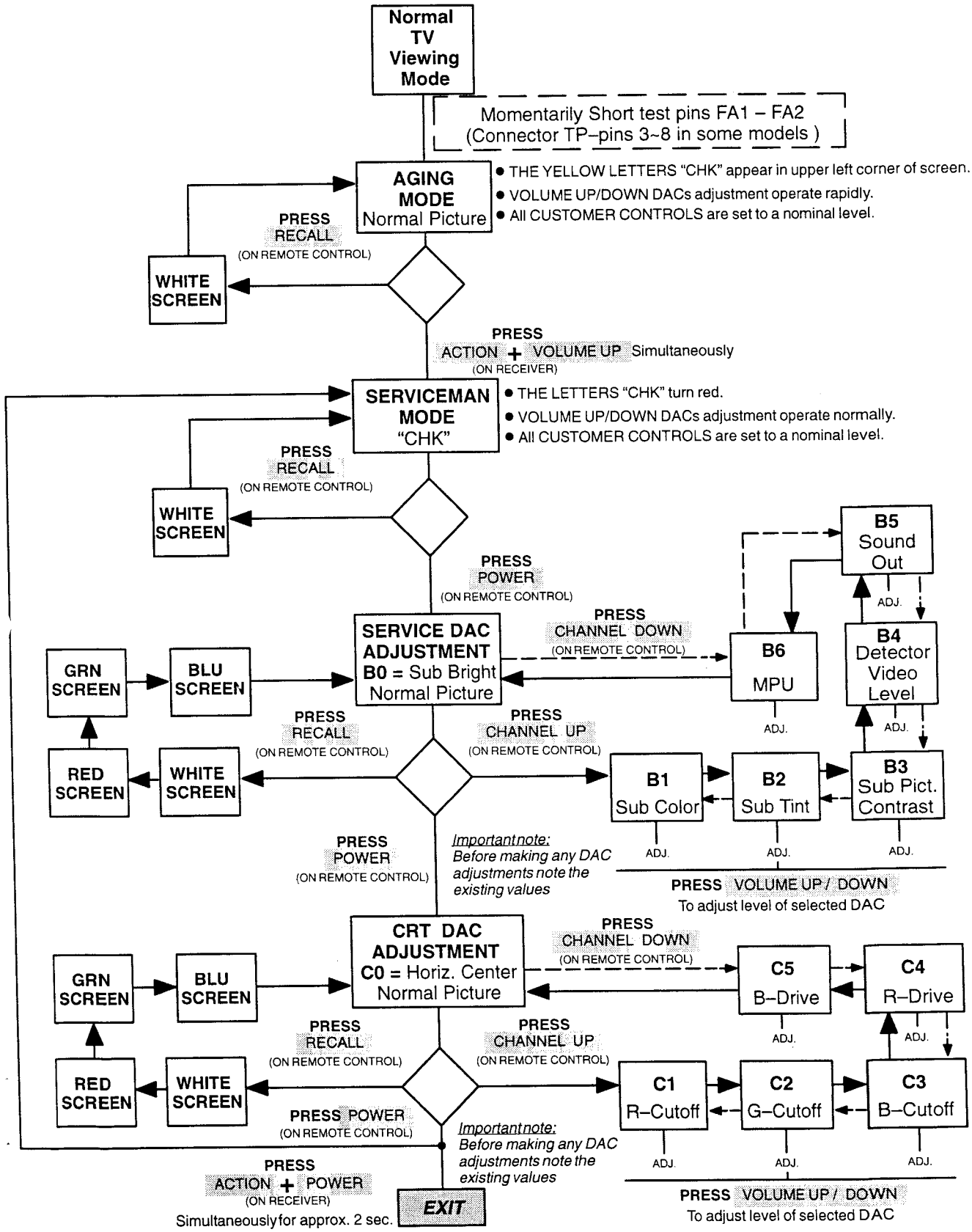
Exit Serviceman Mode:

1. Press ACTION + POWER buttons on Receiver simultaneously for approximately 2 seconds.
   "The Receiver exits Serviceman Mode".

The Receiver momentarily shuts off; then comes back on tuned to channel 3 with a preset level of sound.

Instructional Flow Chart for Serviceman Mode

Caution: Always EXIT Serviceman Mode after use



Receiver shuts off; then turns on, TUNED TO CHANNEL 3 WITH A PRESET LEVEL OF SOUND.

Note: This will also erase any Programmed Channels, Channels Caption data and some other user defined items.

Service Adjustments (Electronic Controls)

Sub–Brightness

Serviceman DAC Adjustment (B0)

Adjustment of this control is important for getting proper operation of customer brightness and picture controls. This adjustment must be made after Sub–Contrast or Color Temperature adjustments are made. **Do not adjust** SCREEN after Sub–Brightness is set.

Preparation:

1. Connect a color bar signal with 100 IRE white and 7.5 IRE black. (Switch Color "OFF" on the generator.) Operate television for a minimum of 10 minutes prior to the adjustment.

Procedure:

1. In Serviceman Mode for making electronic adjustments, select DAC adjustment (B0) and adjust so the black bar starts to look grey. Then decrease the adjustment to the point where grey turns to black.

Video Detector Level

Serviceman DAC Adjustment (B4)

Preparation:

1. Obtain an NTSC color bar pattern with 100 IRE white and 87.5% modulation.
2. Connect oscilloscope to TP12. Use cold ground for scope connection. Set scope at Horizontal rate (20μs) time base.

Procedure:

1. In Serviceman Mode for making electronic adjustments, select DAC Adjustment (B4) and adjust for 1V from sync tip to white level. See detail.

2. Set SUB–CONTRAST adjustment (DAC adjustment B3).

Sub Contrast

Serviceman DAC Adjustment (B3)

This adjustment is factory set. **Do not adjust** unless repairs are made to associated circuit, the CRT Board or the CRT is replaced.

Preparation:

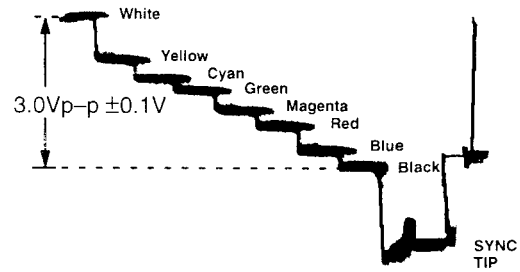
1. Connect a generator pattern with 87.5% modulation, 70% saturated color bar with a 100 IRE white and 7.5 black.

NOTE: The pattern used in this procedure is an EIA color bar pattern with 87.5% modulation with 100 IRE white and 7.5 black. Correlate the information in this procedure to your pattern used.

2. Connect oscilloscope to CRT–Board connector C1–2 (TP35) Set scope horizontal time base to 20μs (horizontal).
3. Connect jumper from TPD2 to ground (⏚).

Procedure:

1. In the Serviceman Mode for electronic adjustments, select DAC Adjustment (B3) and adjust for 3.0Vp–p ±0.1V from white level to black level on video waveform (see video waveforms detail).



2. Remove jumper (Preparation steps 3).

Tint/Color Adjustment

Serviceman DAC Adjustment (B2) (B1)

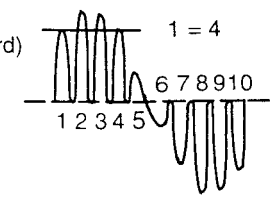
Preparation:

1. Connect a rainbow color bar signal.
2. Connect oscilloscope to TP47R (A–Board) or connector C1 pin 1, TP36 (CRT–Board).
3. Connect jumper from TPD2 to GND (⏚).

Procedure:

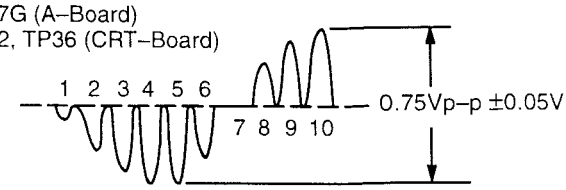
1. In serviceman Mode for making electronic adjustments, select DAC Adjustment (B2) and adjust waveform so peak 1 is the same as peak 4 as shown in the detail.

TP47R (A–Board)
C1–1, TP36 (CRT–Board)



2. Connect oscilloscope to TP47G (A–Board) or connector C1 pin 2, TP35 (CRT–Board).
3. Select DAC adjustment (B1) and adjust for peak to peak waveform to be 0.75V p–p ±0.05V.

TP47G (A–Board)
C1–2, TP36 (CRT–Board)



4. Remove jumpers (Preparation step 3).

Color Temperature Adjustment (B/W Tracking)

Serviceman DAC Adjust. (C1) (C2) (C3) (C4) (C5)

Minor Touch–Up Method

OBSERVE low and high brightness areas of a B/W picture for proper tracking. Adjust only as required for "good grey scale and warm highlights".

- LOW LIGHT areas – In Serviceman Mode for making electronic adjustments, select cutoff (C1) RED, (C2) GRN, (C3) BLU and adjust picture for grey.
- HIGH LIGHT areas – In Serviceman Mode for making electronic adjustments, select Drive (C4) RED, (C5) BLU and adjust for warm whites.

Complete Adjustment

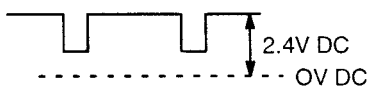
Preparation:

1. Turn Receiver "ON" and allow 10 minutes warm up at high brightness.
2. Apply color bar signal with color "OFF".
3. Turn SCREEN control (part of FBT T551) fully counterclockwise.

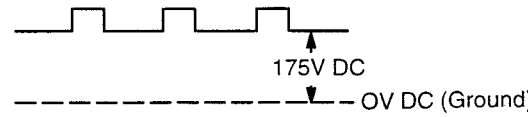
Procedure:

Preset Serviceman DAC's C1, C2 and C3 levels to 128 for best results.

1. Connect oscilloscope to TP35 (CRT–Board).
2. In Serviceman Mode for making electronic adjustment, select Sub Bright (B0).
3. Connect jumper from TPS8 to FA2, (connector TP pin 6 to pin 3).
4. Observe oscilloscope waveform at Horizontal rate and adjust Serviceman Mode Sub Bright DAC (B0) for scanning period of 2.4V above DC ground shown in detail.



5. Remove jumper. (Step 3)
6. Connect scope to GRN Cathode (KG) on CRT–Board.
7. In Serviceman Mode for making electronic adjustments, select GREEN CUTOFF DAC (C2).
8. Connect jumper from TPS8 to FA2, (connector TP pin 6 to pin 3).
9. View scope trace at Horizontal rate and adjust Serviceman Mode DAC (C2) for the scanning period to be 195V above DC ground. (See detail)
10. Remove jumper. (Step 8)
11. Connect scope to RED Cathode (KR).
12. In Serviceman Mode for making electronic adjustments, select RED CUTOFF DAC (C1), connector TP pin 6 to pin 3).
13. Connect jumper from TPS8 to FA2, (connector TP pin 6 to pin 3).
14. View scope trace and adjust Serviceman Mode DAC (C1) for the scanning period to be 195V above DC ground. (See detail)
15. Remove jumper. (Step 13)
16. Connect scope to BLU Cathode (KB).
17. In Serviceman Mode for making electronic adjustments, select BLU CUTOFF (C3).
18. Connect jumper from TPS8 to FA2, (connector TP pin 6 to pin 3).
19. View scope trace and adjust Serviceman Mode DAC (C3) for the scanning period to be 175V above DC ground. (See detail)



Adjustment Waveform Detail (Steps 9, 14, 19)

20. Turn Screen Control (part of FBT) slowly clockwise until a color horizontal line appears.
21. With the other two colors Serviceman Mode DAC CUTOFF adjustments (C1) RED, (C2) GRN, (C3) BLU; increase their colors to create a white horizontal line.
22. Remove jumper. (Step 18)
23. Confirm good gray scale by viewing B/W color bar pattern.
24. In Serviceman Mode for making electronic adjustments select DAC DRIVE adjustments (C4) RED, (C5) BLU and adjust for warm white in white color bar of pattern.
25. EXIT Serviceman MODE.
26. Adjust Picture Menu Video Adjustments BRIGHT and PICTURE from low scale to high scale and check Black and White tracking.
27. If correction needed: Re–Enter Serviceman Mode and perform **Minor Touch – Up Method.**
28. Perform SUB BRIGHTNESS adjustment procedure.

Horizontal Centering

Serviceman DAC Adjustment (C0)

Preparation:

1. Connect crosshatch generator.

Procedure:

1. In Serviceman Mode for making electronic adjustments. Select DAC adjustment (C0) and adjust so center of crosshatch pattern is centered on CRT screen.
2. EXIT Serviceman Adjustment Mode.

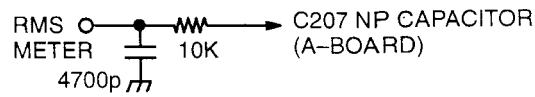
Sound Out

Serviceman DAC Adjustment (B5)

This adjustment is factory set and needs to be performed only when IC002 or IC101 is replaced.

Preparation:

1. Connect 400Hz. 100% modulation (25KHz deviation) signal generator to antenna (70db ±5db, 75Ω open P/S 10db). Generator pre–emphasis must be "OFF" for 1KHz.
2. Connect RMS Meter with filter jig as shown in detail.



Procedure:

1. In Serviceman Mode for making electronic adjustments, select DAC adjustment (B5) and adjust for RMS meter reading of:
   150mV rms ±5mV rms. (Stereo Models)
   250mV rms±15mV rms (Mono Models)
2. EXIT Serviceman Adjustment Mode.

MPU Reference Oscillator (B6)

Preparation:

1. Connect frequency counter from TPS1 (IC001 Pin 25) to cold ground (⏚).

NOTE: Frequency Counter probe capacitance should be 8PF or less.

Procedure:

1. Turn Receiver "OFF" with AC power applied.
2. Measure TPS1 (IC001 pin 25) for the period of the waveform (record reading).
3. Turn Receiver back "ON".
4. Place Receiver into serviceman Mode for making electronic adjustment, select DAC Adjustment (B6).
5. Set (B6) based on following formula:

$$B6 = 1350128 - \frac{7372800000}{\text{pin 25}}$$

NOTE: After the proper number is loaded into B6, pin 25 measurement will remain the same as previously measured.

Sample chart for loading B6 (register range is 0 thru 255).

B6 register	pin 25 reading
0	5460.816
1	5460.820
2	5460.824
127	5461.329
128	5461.333
129	5461.337
253	5461.839
254	5461.843
255	5461.847

NOTE: If TPS1 (IC001 pin 25) is measured in Hz unit with the Frequency Counter use following formula:
B6 = 13501028 – [7372.8 x pin 25 (Hz)]
Must have at least four digits of resolution behind decimal point for pin 25 reading.
Sample: 000.0000

Service Adjustments (Mechanical Controls)

RF AGC Delay R106

Adjust only if overloading on strong signal or busy background (snow) is present on moderate strength signals.

1. Adjust RF AGC control R106 until snow appears in picture, then adjust control until snow is eliminated.
2. Check all channels for optimum setting.

AFC Field Adjustment L103

1. Select TV signal mode with Menu.
2. Defeat AFC by applying jumper from TPS7 (R063) to ground (⏚).
3. Connect a digital voltmeter to AFC test point TP16.
4. Use Remote Control to Check all active High Band channels 7~13 for AFC voltage range. Select channel with AFC voltage in approximate center of voltage range.
5. Adjust L103 for 4.6V ±0.1V at TP16.
6. Check all active channels for proper AFC correction. Touch up L103 if required. Remove jumper in step 2.

NOTE: Do not use TV/CABLE channel with offset carriers for adjustment or in determination of low and high range of AFC voltage.

Sound Alignment L201

1. Select active TV channel.
2. Attenuate signal (loosely couple antenna lead or use RF attenuator pad) for noisy sound.
   - Adjust L201 for maximum sound. Signal to noise ratio is best when L201 is peaked.
3. Connect antenna or remove RF attenuator for strong signal.

Vertical Size R453

1. Turn VERTICAL SIZE control R453 CCW until top and bottom edges of raster are visible.
2. Adjust VERTICAL SIZE control CW until top and bottom of raster touch bezel edge. Advance SIZE control CW an additional 30 degrees. This will be approximately 10% overscan. Linearity adjustment is automatic with size adjustment. (Best results can be obtained with a round test pattern.)

Focus (Part of T551)

Preparation:

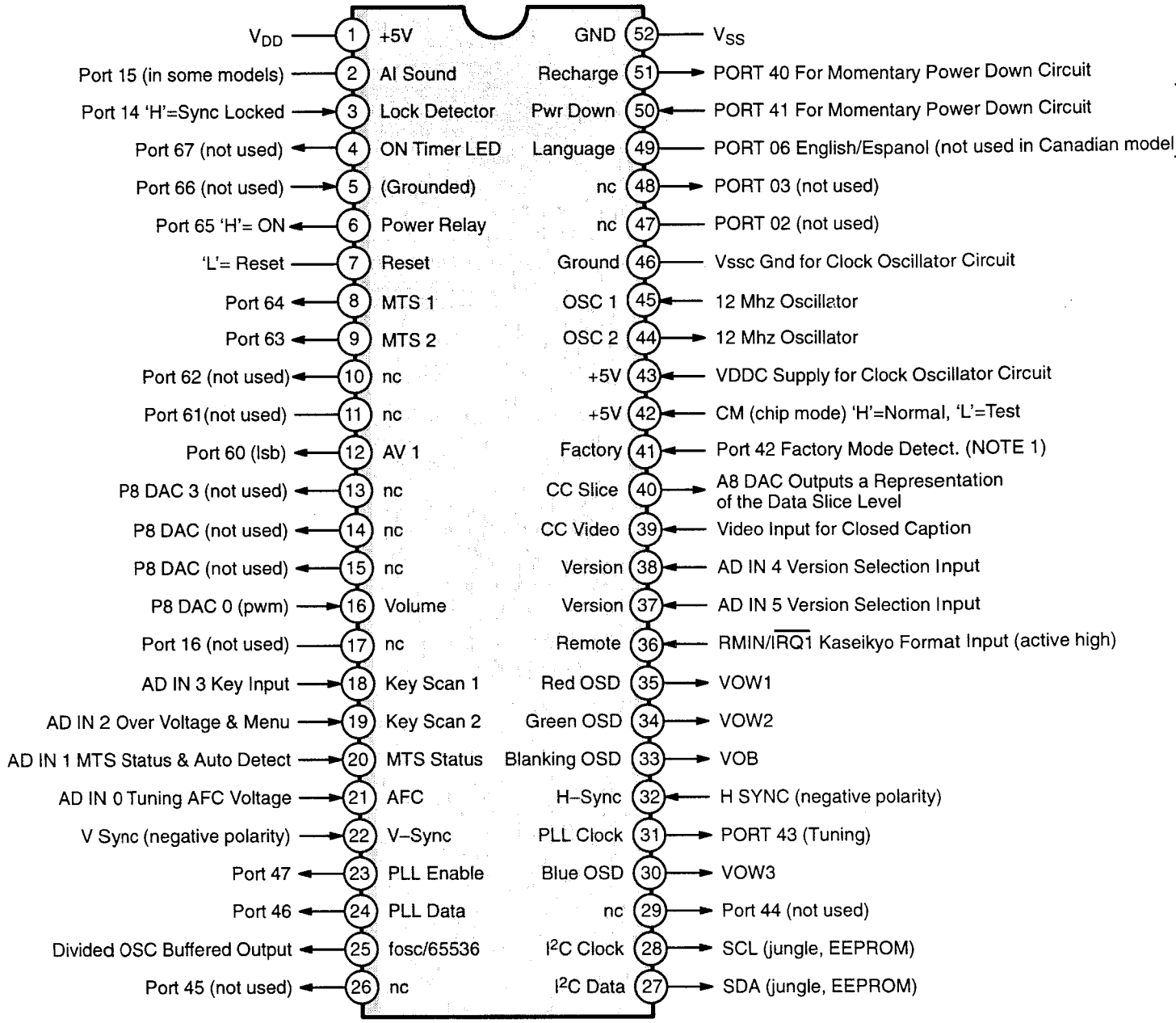
1. Connect Signal generator and select dot pattern.

Procedure:

1. Adjust the FOCUS control to obtain the sharpest and clearest dot pattern.
   (a) adjust for best center
   (b) adjust for best area between center and top right corner.

New Circuits

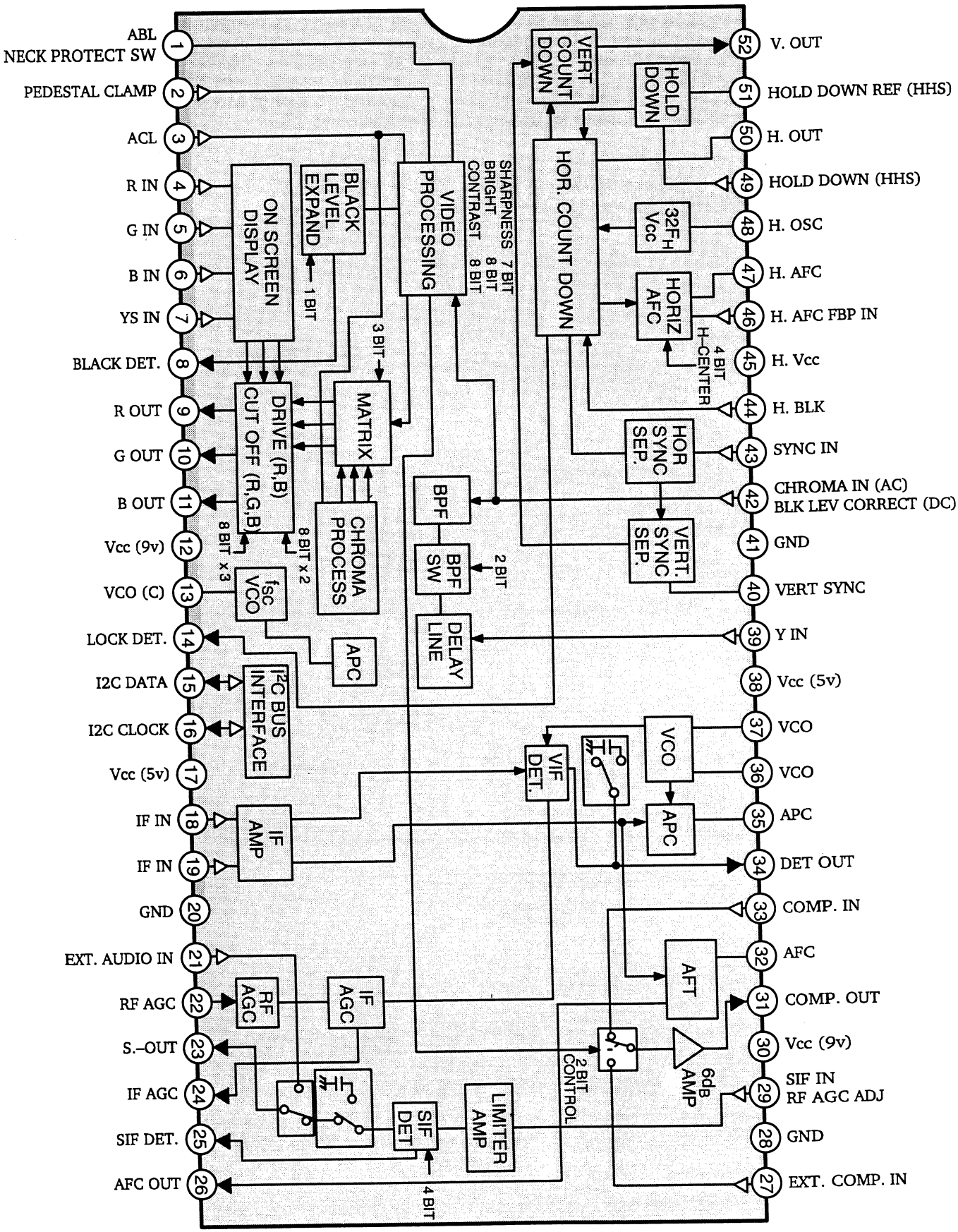
IC001 MPU IN/OUT Pins and Functions


VDD 1 +5V
Port 15 (in some models) 2 AI Sound
Port 14 'H'=Sync Locked 3 Lock Detector
Port 67 (not used) 4 ON Timer LED
Port 66 (not used) 5 (Grounded)
Port 65 'H'= ON 6 Power Relay
'L'= Reset 7 Reset
Port 64 8 MTS 1
Port 63 9 MTS 2
Port 62 (not used) 10 nc
Port 61(not used) 11 nc
Port 60 (lsb) 12 AV 1
P8 DAC 3 (not used) 13 nc
P8 DAC (not used) 14 nc
P8 DAC (not used) 15 nc
P8 DAC 0 (pwm) 16 Volume
Port 16 (not used) 17 nc
AD IN 3 Key Input 18 Key Scan 1
AD IN 2 Over Voltage & Menu 19 Key Scan 2
AD IN 1 MTS Status & Auto Detect 20 MTS Status
AD IN 0 Tuning AFC Voltage 21 AFC
V Sync (negative polarity) 22 V–Sync
Port 47 23 PLL Enable
Port 46 24 PLL Data
Divided OSC Buffered Output 25 fosc/65536
Port 45 (not used) 26 nc
GND 52 VSS
Recharge 51 PORT 40 For Momentary Power Down Circuit
Pwr Down 50 PORT 41 For Momentary Power Down Circuit
Language 49 PORT 06 English/Espanol (not used in Canadian model
nc 48 PORT 03 (not used)
nc 47 PORT 02 (not used)
Ground 46 Vssc Gnd for Clock Oscillator Circuit
OSC 1 45 12 Mhz Oscillator
OSC 2 44 12 Mhz Oscillator
+5V 43 VDDC Supply for Clock Oscillator Circuit
+5V 42 CM (chip mode) 'H'=Normal, 'L'=Test
Factory 41 Port 42 Factory Mode Detect. (NOTE 1)
CC Slice 40 A8 DAC Outputs a Representation of the Data Slice Level
CC Video 39 Video Input for Closed Caption
Version 38 AD IN 4 Version Selection Input
Version 37 AD IN 5 Version Selection Input
Remote 36 RMIN/IRQ1 Kaseikyo Format Input (active high)
Red OSD 35 VOW1
Green OSD 34 VOW2
Blanking OSD 33 VOB
H–Sync 32 H SYNC (negative polarity)
PLL Clock 31 PORT 43 (Tuning)
Blue OSD 30 VOW3
nc 29 Port 44 (not used)
I2C Clock 28 SCL (jungle, EEPROM)
I2C Data 27 SDA (jungle, EEPROM)

NOTE 1:
Momentarily pulling pin 41 to ground and releasing it will put the microprocessor into factory aging mode. Holding this line at ground will inhibit microprocessor access to I^2C bus line.

IC101 Block Diagram

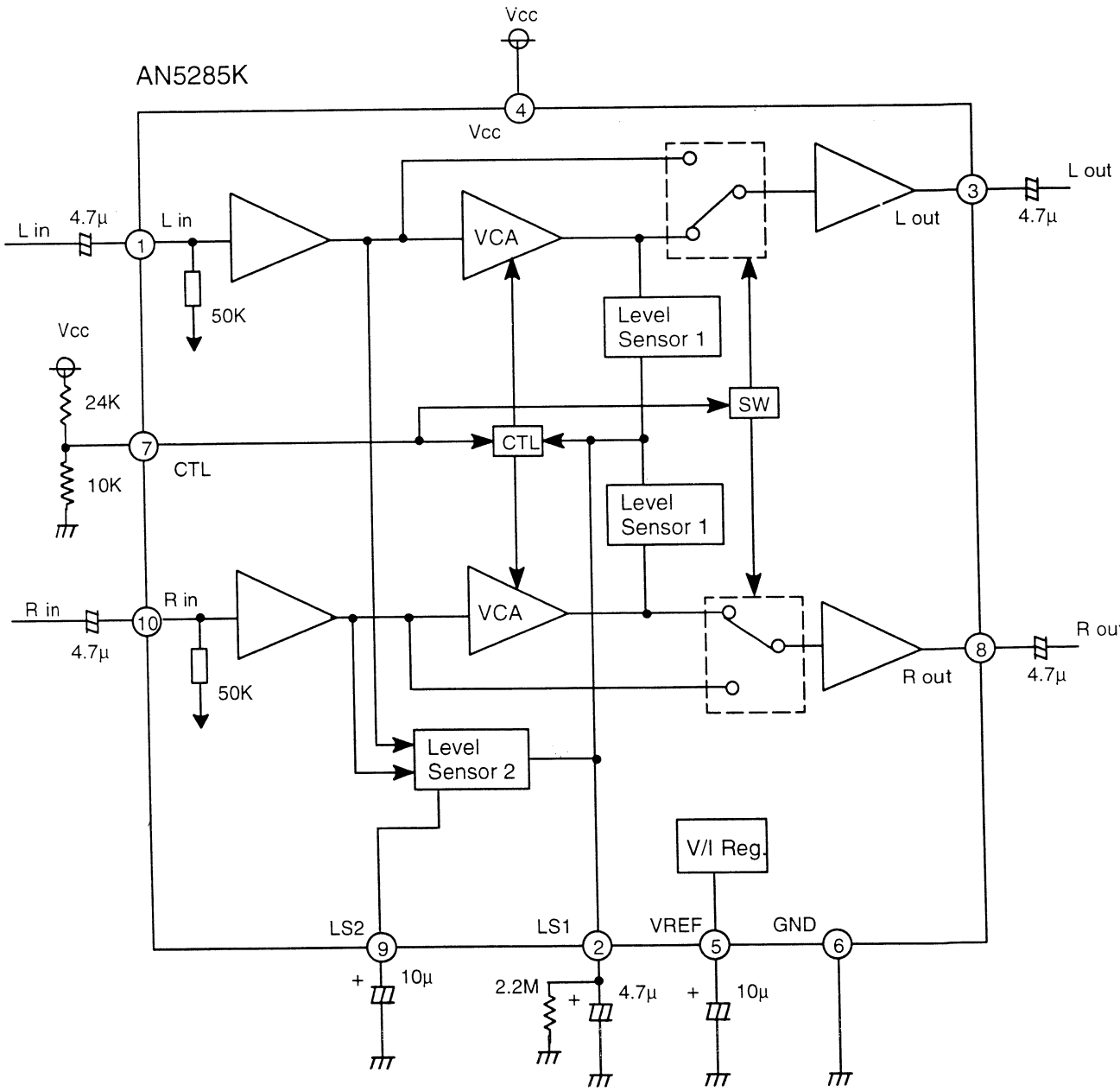
INPUT PINS = ▽ △ OUTPUT PINS = ▲ ▼



*AIS (Artificial Intelligence Sound)

This receiver uses Artificial Intelligence (AI) Sound to modulate abrupt changes in sound volume level. It is primarily designed to prevent sudden loud changes in sound volume, such as those which occur when a television program is interrupted by a commercial. It also equalizes the maximum volume level when switching between different channels or when switching between broadcast and other A/V sources.

The AIS circuit is incorporated into the system through the use of an Automatic Gain Circuit, IC2451, which is located on the A–Board. AIS activation is MPU controled through the IC's switch terminal at pin 7. Right and left channel sound enters the circuit at pins 1 and 10 respectively, wher they are sampled, then either amplified or dampene according to preset levels. The "streamlined" sound is then outputed through pins 3 and 8 (left and right channels respectively).

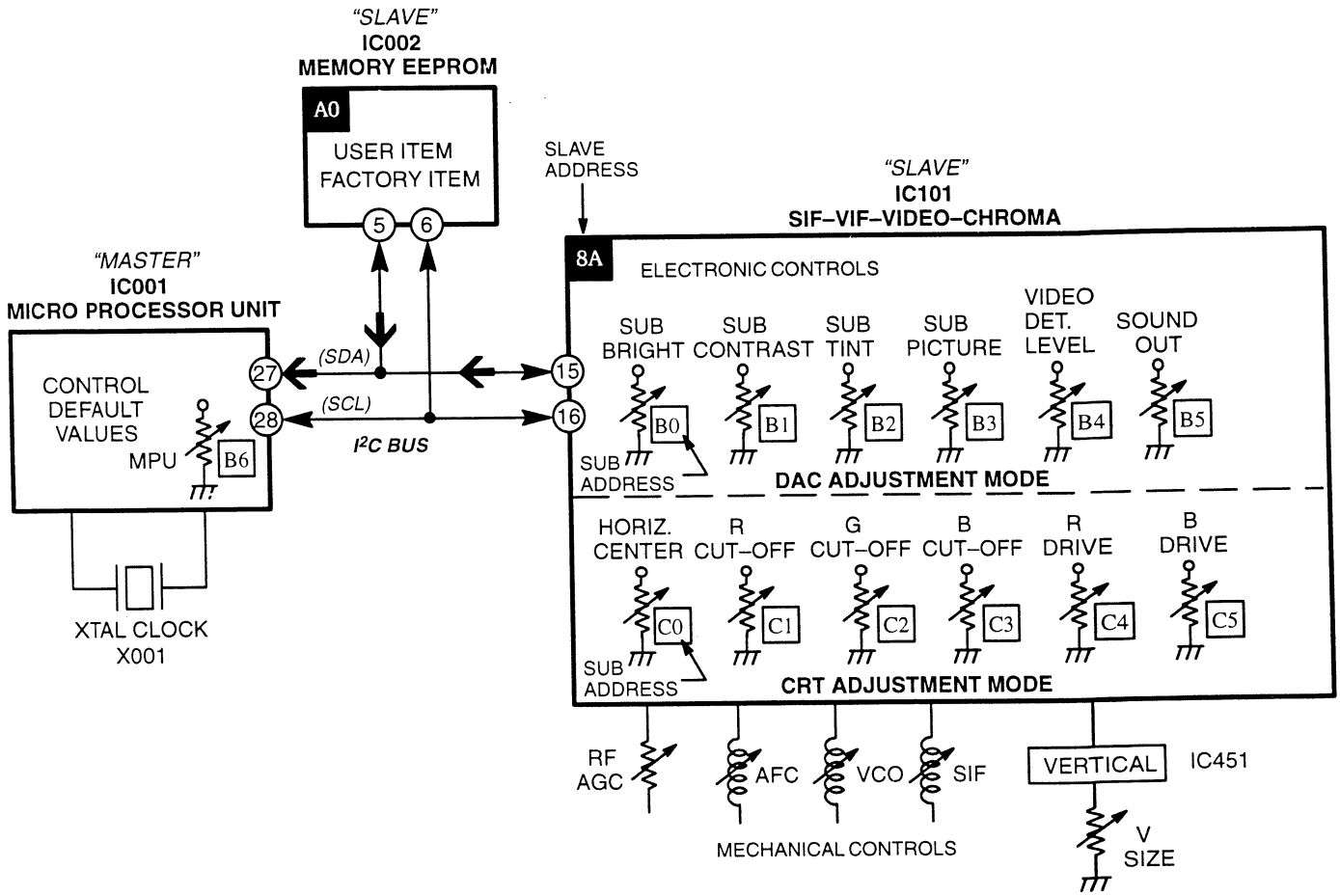


I²C Bus Line System

This Receiver makes use of one of the latest electronic technologies by using an I²C (Inter–Integrated Circuit) Bus Line Concept. Two wires, SDA (Serial Data) and SCL (Serial Clock) carry information between devices connected to the Bus. Each device connected to the Bus has a unique address for receiving data information (a Receiver) from a source (the Transmitter).

The devices are also considered to be a "Master" or a "Slave" when data is transmitted or received. In this Receiver, the "Master" (Micro Processor Unit, IC001) is the device which initiates a data transfer in the Bus line and generates the clock signal required to permit the data to be sent. The "Slaves" (MEMORY I²C EEPROM, IC002 and VIF–SIF–VIDEO–CHROMA JUNGLE, IC101) are the devices addressed by the MPU and receive the data transmitted.

This system usually performs as a control function and replaces many of the required mechanical controls needed in a television receiver. Instead of adjusting various mechanical controls individually, many of the control functions can be performed electronically using "On Screen Menus", (The Serviceman Mode).



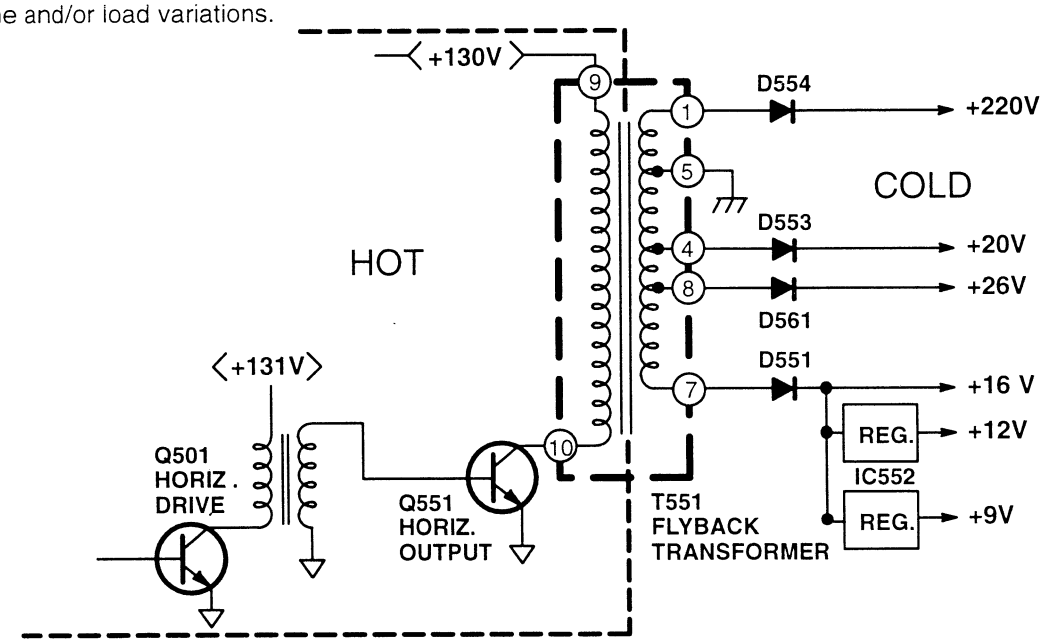
AVR Power Supply

B+ Source Voltages

The NA3C chassis B+ source voltages are derived from secondary windings on the flyback transformer (T551).

B+ for the Horizontal Drive, Horizontal Output (Q501/Q551) and Flyback Transformer (T551) is supplied by an AVR (Automatic Voltage Regulator) 130 volt output. Since the secondary B+ voltages are dependant on scan waveform or flyback pulse amplitude, these voltages are also regulated for AC line and/or load variations.

The +20 volt, +16 volt and +26 volt supplies are derived by diode rectification of the scan waveform and are relatively high current supplies. The 16 volt B+ source is also coupled to a 12 volt and 9 volt regulator. IC552 supples +12 volt B+ to the Audio circuit while IC552 supplies +9V B+ to most of the Main Board circuitry. The +220 volt for CRT is developed from diode rectification of the flyback pulse.



Horizontal Hold Down Circuit

This circuit protects against excessive high voltage and CRT beam current. If for any reason high voltage and/or CRT beam current exceeds a predetermined level, the Hold Down Circuit operates to increase horizontal frequency. If the level increases more, the Hold Down Circuit will blank the CRT.

CRT heater voltage from pin 6 of flyback transformer (FBT) T551 is rectified by diode D531. This voltage is directly proportional to high voltage variations. The voltage is filtered and divided down by precision resistors R532/R533 to approximately 2.4V and applied to Pin 49 (Hold Down) of IC101. With this voltage as a normal condition, the Hold Down Circuit is inactive and has no effect on horizontal frequency or blanking the CRT.

The Hold Down Circuit inside IC101 is a (NPN) differential amp. One base of the differential amp is connected to Pin 49 (approximately 2.4V). The other is connected to Pin 51 through an internal voltage divided of equal resistance. Pin 51 is clamped at a 6V DC reference voltage by zener diode D532. The voltage at the base of the differential amp is 3V. (1/2 of the reference voltage, 6V)

Basically, the Hold Down Circuit compares the voltage at Pin 49 (approximately 2.4V) to half of Pin 51 (clamped 6V). If CRT heater pulse amplitude from T551 (representative of high voltage) increases, the positive voltage at the cathode of D531 and at Pin 49 of IC101 also increase.

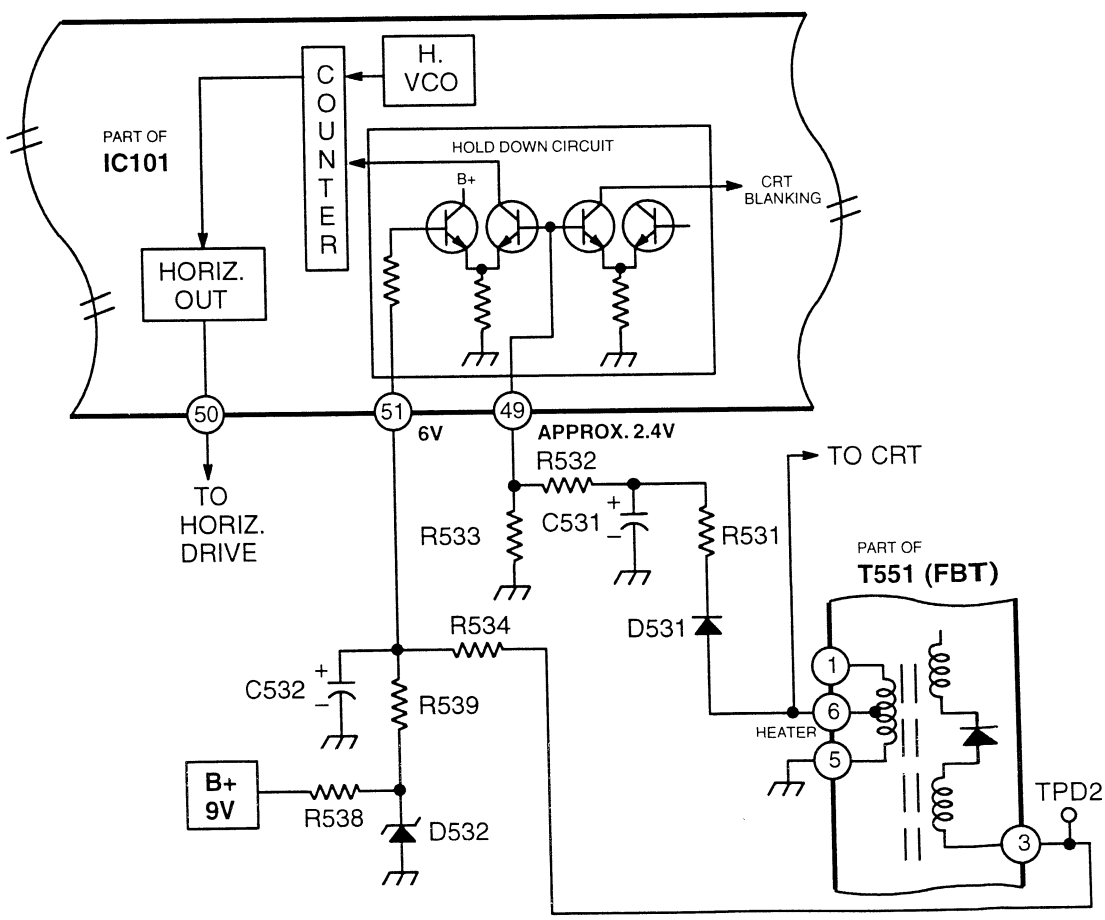
When the increased DC voltage at Pin 49 exceeds half of the Pin 51 reference voltage by a predetermined amount, the Hold Down Circuit (differential amp) changes conduction state and shifts the horizontal count down for a higher sweep frequency (out of sync condition) to prevent unsafe operation. For further safety when the Pin 49 voltage is extremely excessive, another internal differential amp changes state to blank the CRT.

An increase in CRT beam current produces more negative ABL voltage at Pin 3 of T551 (FBT) which is coupled to Pin 51 of IC101 via resistor R534. This increased negative voltage opposes the positive voltage at Pin 51 and lowers the DC reference voltage to less than 6V. This in turn causes the Hold Down Circuit to operate sooner when Pin 49 voltage increases.

Thus excessive levels of high voltage and/or increased CRT beam current cause determining of the horizontal oscillator frequency and eventual blanking of the CRT to assure operation within safe limits.

The B+ circuit and the Hold Down Circuit are not adjustable. If components in the designated areas of the schematic for critical parts are changed, operation of the Hold Down Circuit must be checked to insure that high voltage and CRT beam current does not exceed safe operation parameters. Check the following for possible failure:

1. Measure the DC voltage at Pin 49 of IC101 (reading should be close to +2.4V). If not, check D531, R531, C531, R532, R533 and IC101.
2. Measure the DC voltage at Pin 51 of IC101. (reading should be +6V) if not, check R534, C532, R539, D532, R538 and IC101.



CRT Protection Circuit

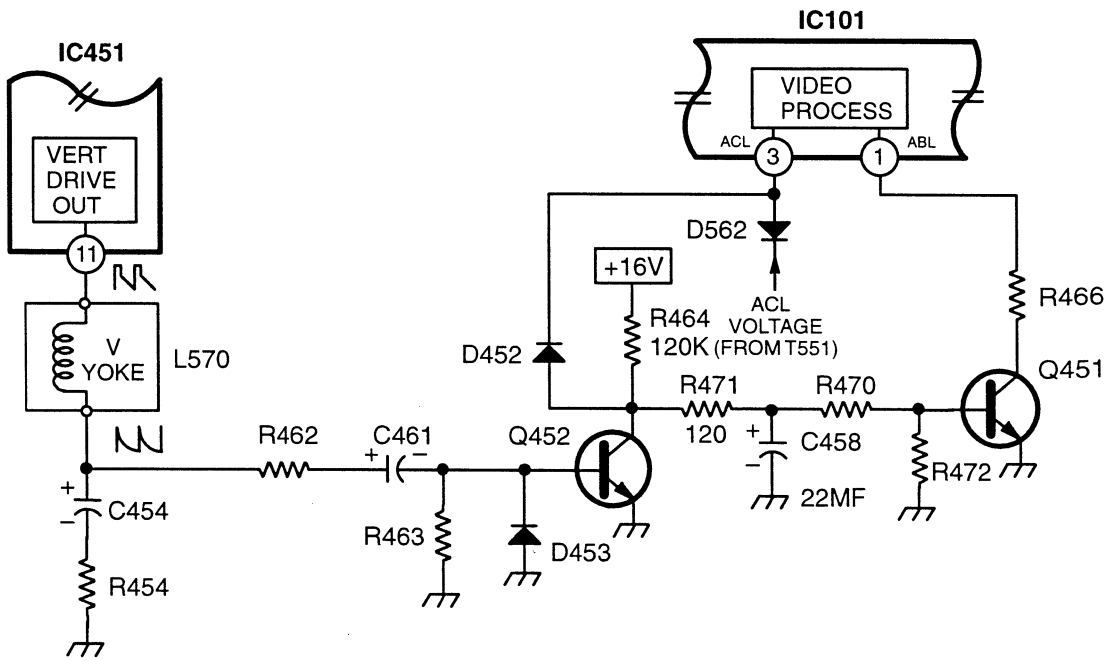
The CRT Protection Circuit is made up of transistors Q452 and Q451. The circuit blanks the CRT in the event of vertical sweep loss.

During normal operation, Q452 monitors vertical sweep by being connected to the low side of the vertical yoke L570. When Q452 is off, C458 starts to charge up from the 16V source through resistors R464 and R471. The RC time constant is such that the charging is slow. When Q452 is conducting, C458 discharges through R471 and the transistor to ground. The RC time constant is such that the discharge is fast. The slow charging and fast discharging along with voltage divider R470/R472 prevents sufficient bias for transistor Q451 to conduct. With Q451 not conducting, Pin 1 of IC101 is high and ABL functions normally.

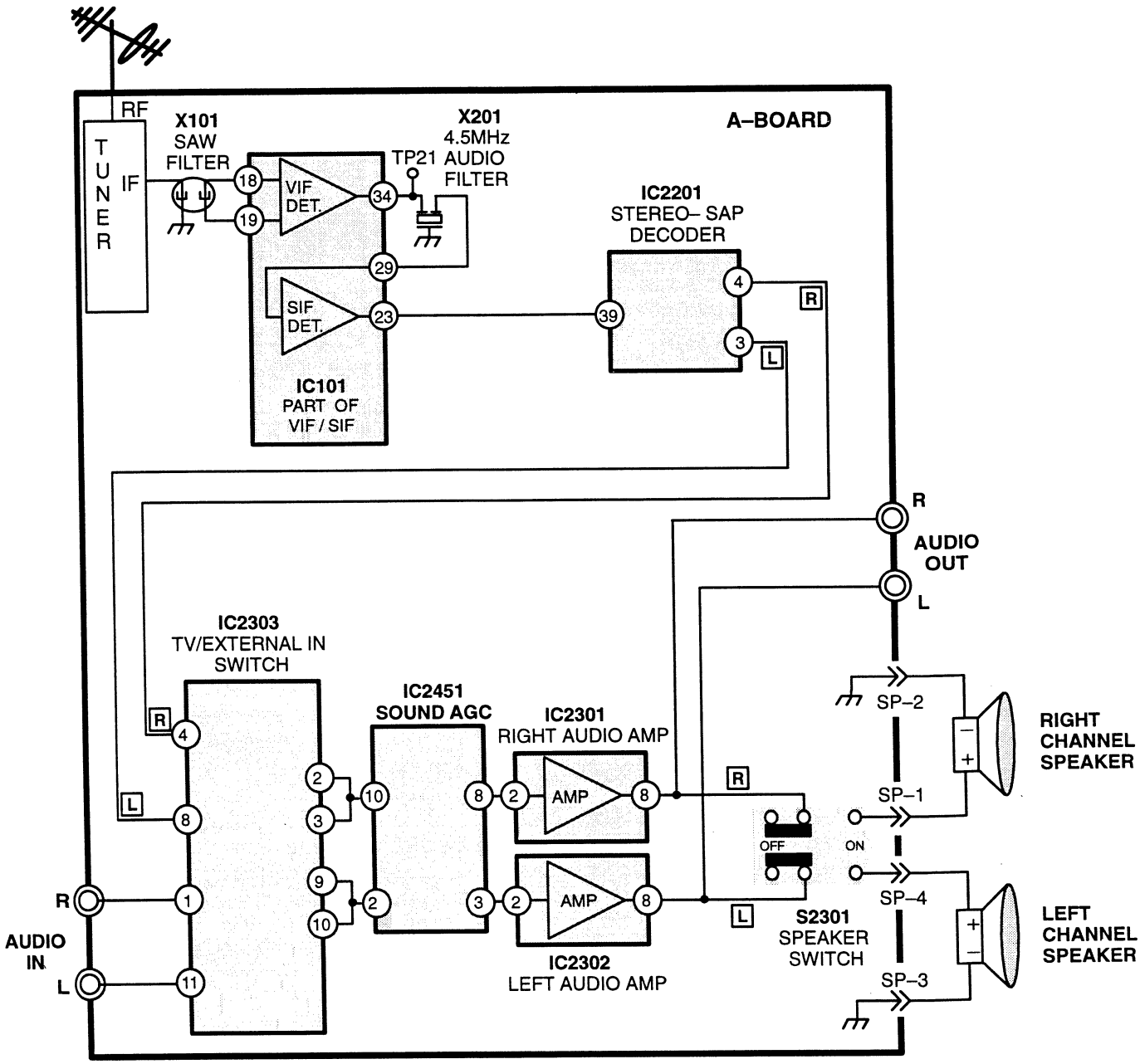
If yoke current ceases (due to an open yoke or no voltage at IC451 Pin 11), there is no base bias for transistor Q452. The transistor is now always non conductive. Capacitor C458 is now allowed to charge a longer time to supply enough bias through voltage divider R470/R472 for Q451 to conduct. When it does, the voltage at Pin 1 of IC101 goes low and cuts off CRT beam current.

Diode D452 is added to the collector of Q452 to prevent the circuit from operation when Pin 3 of IC101 is grounded for Service Switch function when setting CRT cutoff.

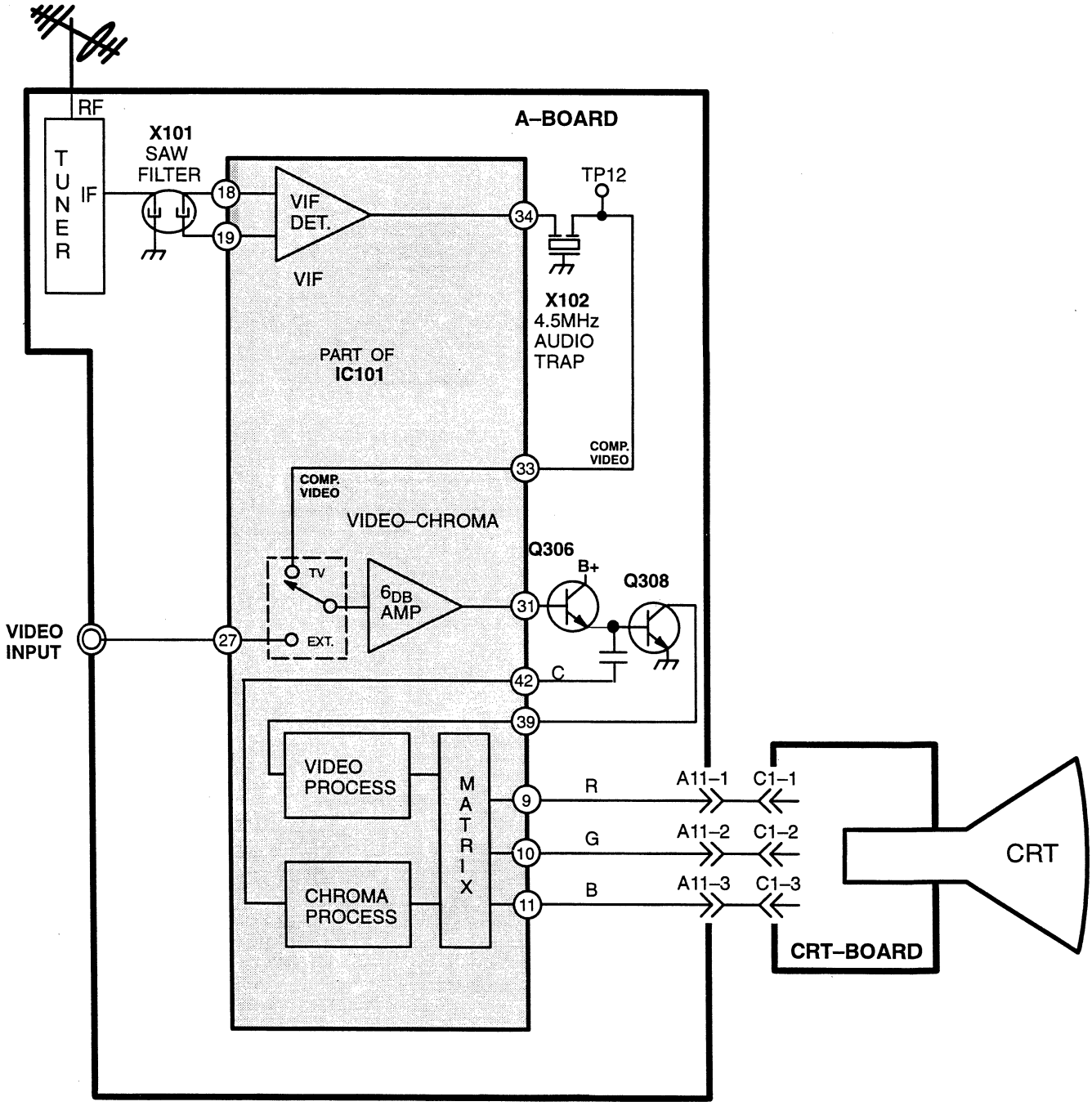
It is important for CRT life that this circuit be checked before returning a repaired receiver to a customer. A quick test is to short Q452 base to ground. The CRT should blank. If not, troubleshoot the circuit for cause.



Audio Signal Path Block Diagram



Video–Chroma Signal Path Block Diagram



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